DENTAL LABORATORY.

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THE

DENTAL LABORATORY

A MANUAL OF

GOLD AND SILVER PLATE WORK

—FOR—

DENTAL SUBSTITUTES, CROWNS, ETC. REGULATING APPLIANCES FOR IRREGULAR TEETH, REPAIRING ETC.

TO WHICH IS ADDED

MANIPULATIONS IN VULCANITE AND CELLULOID, LABORATORY HINTS, SUGGESTIONS, FIXTURES, ETC.

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TO THE

STUDENTS OF DENTISTRY

ATTENDING THE VARIOUS COLLEGES
IN THE UNITED STATES,

AND TO THOSE CONTEMPLATING THE

STUDY OF DENTISTRY,

THIS WORK IS RESPECTFULLY DEDICATED BY

THE AUTHOR.

PREFACE.

The object of this little work is to place into the hands of the dental student some directions and suggestions in the manipulation of the laboratory; for the construction of artificial dentures on gold and silver plates; the making and fitting of all gold crowns, and crowns with porcelain facing; regulating appliances in metal, as well as vulcanite and celluloid work, and all of the most prominent manipulations of the laboratory.

It has been the aim of the author to treat and select all such cases as occur in the every-day practice of the dentist, both in the construction of new work and in the repair of old, and to present these in the simplest and most explanatory manner; and his efforts, to this end, have been seconded by the publishers in the most profuse illustrations, whereby nothing is left wanting for the most complete understanding of the cases treated.

With the hope that his efforts to aid may be available, and that his experience, clearly set forth and neatly illustrated, may assist in making what was not well understood before, completely comprehended, we place our little book in the hands of the dental practitioner and student, with the best wishes that it may do good in the field we desire the good seed to grow.

CHAPTER I.

THE DENTAL LABORATORY.

We propose in the following pages to set forth the arrangement of a dental laboratory, as well as to offer such suggestions for the conveniences of work, and appliances, and materials, as our experience dictates, to those who do their own laboratory work.

First, the *Work-bench.* This should be a shelf or table placed before a window. The top should be made of some hard close-grained wood, about *two inches* thick by not less than *eighteen inches* wide; and about *six or seven* feet long, and raised about *two feet eight inches* from the floor.

The table should have two sets of drawers, these being graduated in depth, to keep tools of larger or smaller dimensions, and each set of these drawers should be placed on the right side of semilunar cuts, removed from the top of the table. The following cut, Fig. 1, illustrates the work-bench.

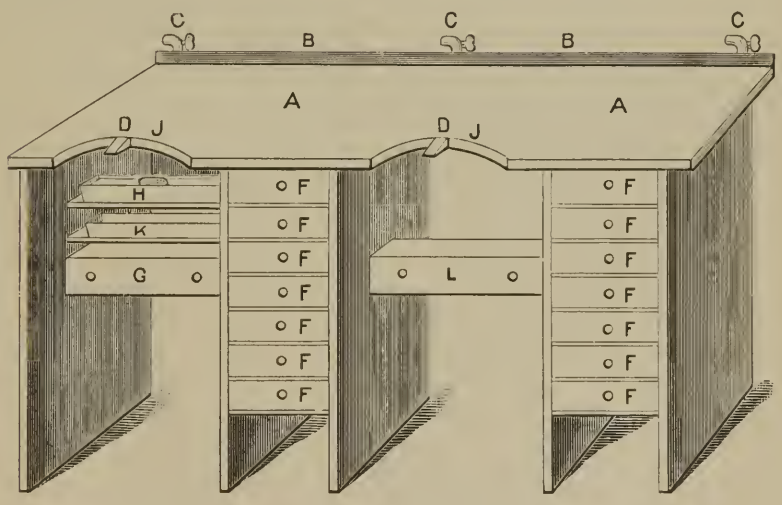


Fig 1.

JJ represents the semilunar cuts, with what is termed *a wedge*, at D in each. The wedge is mortised into the top of the table A, and is most convenient to hold the work against while filing. It is particularly recommended to have these places cut out from the top of the table instead of having the top of the table straight, as the filings fall more certainly from the wedge into the drawer below. This is of considerable importance to avoid loss or wastage when working with the noble metals,

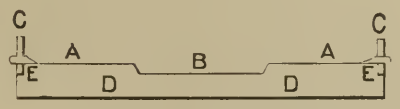
gold, platinum and silver. B represents a gas pipe with three outlets at C, to which rubber tubing may be attached, for such work as requires heat. F represents the drawers placed on the right side of the bench and to the right of the workman. These drawers should vary from *one inch* (inside measurement) to *four inches* in depth. In these drawers the tools should be kept, *and not on the table*, except while working with them. G is a large, deep drawer, about three inches deep, placed in front of the semilunar cut under the wedge, and capable of being drawn out over the lap of the workman so that the gold box H may be put into it, to catch the gold or other precious filings when working in the noble metals When not in use the gold box H is kept for convenience on a shelf out of the way, beneath the top of the table, as represented in the engraving. K is also a tin or sheet-iron box, kept as represented on its shelf when not in use, but put into the drawer G when working in silver. A description of the construction of the gold box will be given further on.

The tools, files, reamers, etc., should never be put into this gold box while working, as the filings adhere to them, and much loss or wastage is incurred in this way It will be seen that the arrangement for gold and silver work is on the *left side*. On the *right side*, only a large drawer L is shown, as this part of the bench being used for vulcanite or celluloid work, no arrangement is made to catch the filings except the drawer to keep these, which are valueless, from falling over and littering up the floor. It has been suggested to keep the tools in a tool rack *on the bench*, but it has been our experience that tools are kept in better order in drawers, except when they are nickel-plated. By keeping each class of tools always in the same drawers and in the same place, the workman soon learns, by habit, just where to find the tool he wants. Thus the plyers, shears, nippers, slide tongs, plate punch, &c., &c., and tools of this class, are kept in one drawer, and being in drawers are saved from the rust occasioned by the fumes of acid, water or steam. The files, reamers, mouth blow pipe and such small flat tools are preferably kept in the shallower drawers, and so on, until each drawer has its tools, and a place or compartment for each class of tools; and in observing order and system while at work, not only much valuable time is saved, but better work can be accomplished than if the workman permits confusion to reign on his work-table, not knowing where to lay his hand on the tool he needs. "Clean up as you work," and do not permit dirt to accumulate, is one of the best rules for a laboratory.

The box for the gold should be made of tin. Its dimensions may be arbitrary, but we would recommend one of the following dimensions: Seventeen inches long, twelve inches wide, and two and a half inches deep. It should be bound along its edge with wire, to give it more strength, and a cover made to fit into it having a raised edge or rim a half inch high. In the centre of this cover is a depression made of per-

forated tin, through which the filings fall into the box beneath. The following cuts (one of which is sectional) will better illustrate its construction.

Fig. 2.



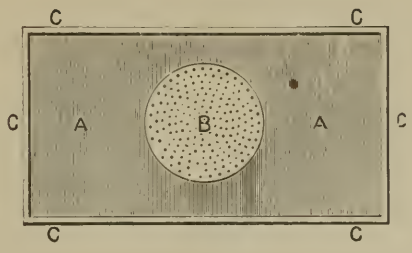


Fig. 3.

Fig. 2 represents a sectional view of the gold box cut through its centre. C are the raised edges of the cover; A, the top of the cover; B, a depression in the cover made of perforated tin, through which the filings fall into the box D, below. E represents the inner rim of the cover to hold it steadily on the box D.

Fig. 3 represents a full view of the cover, showing the edges C, the depression B, through which the filings drop, and A, the top of the cover.

With a gold box, constructed as the one described, the saving by wastage of gold filings would soon pay for the cost of its construction.

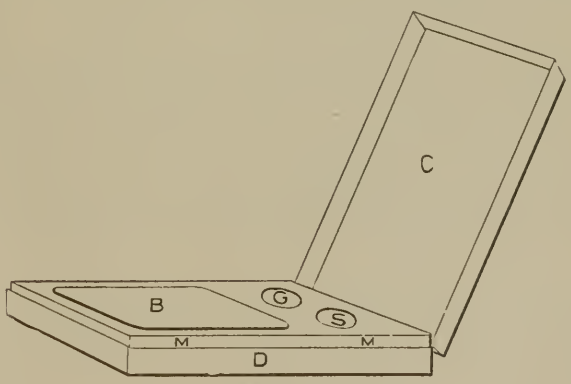


Fig. 4.

Another convenience for gold and silver solder is a piece of marble instead of slate. We have had one for many years, and it will last, as far as wear is concerned, for ages. It is simply a piece of white unpolished marble slab, one inch (or less) thick, five inches wide and six inches long. Towards one end two depressions are cut or sunk ⅛ of an inch deep, one to keep gold and the other to keep silver solder in; while the largest part

of the slab is similarly cut or sunk for the purpose of rubbing up the borax with water. It is mounted for convenience and security against loss and dirt in a tin box to which a cover is hinged. Fig. 4 illustrates the box. C is the cover, hinged to D, the box which holds or encloses the marble slab. B is the large depression for rubbing up the borax with water; G the depression to keep gold solder in, S the depression for silver solder. M is the marble slab within the box.

We will describe the necessities of the laboratory, and will therefore begin from the time the impression is brought in for the construction of a set of teeth.

When such an impression is brought in, from an edentulous mouth, the chances are that this is perfect; that is, in so far that in its removal from the mouth, the impression has not been broken. In partial cases, however, where there are natural teeth remaining in the mouth, it is almost impossible to remove such an impression from the mouth without its being broken into quite a number of pieces. The first thing to be done then, when a partial impression is brought to the laboratory, is to replace the broken pieces so that the impression may be entire. For this purpose *adhesive wax* will be needed to stick the broken parts together, as also small pieces of *iron wire* to strengthen the parts thus gummed together.

ADHESIVE WAX.

This is made as follows:

Gum Demar,	7 parts.
Wax,	4 "
Vermilion (to color),	½ part.

After melting the above together, and before it gets entirely cold, it should be pulled like molasses candy and formed into small sticks like a lead pencil, for convenient use, the fingers being well oiled while doing this. In the absence of Gum Demar, rosin may be substituted, and it is recommended to increase the proportion of the gum to make the material harder in warm weather. The coloring material may be left out if thought proper.

In putting the broken parts of the impression together, nothing should be put over the fractured surfaces. These should be nicely and closely approximated, so that they will lie in the most intimate relation to each other, so close that the fracture cannot be seen, and then the adhesive wax put on the outside of the impression so that it will not interfere with the part of the model which it is necessary to have perfect.

The broken partial impression being approximated, they are gummed together with adhesive wax. As there is not much strength in this wax, small pieces of iron wire, cut up in lengths of about one-half inch (and kept in a small box for use), are taken with the tweezers, held for an instant in the blaze of the spirit lamp, and dropped, while hot, into the

adhesive wax previously gummed to the broken impression. These pieces of iron wire should be laid at right angles to the crack or break in the impression to give support to the broken impression.

The partial impression being thus repaired, it, as well as an impression for an entire set of teeth, is next varnished with *shellac varnish.*

SHELLAC VARNISH.

To make this, a certain quantity of *gum shellac* is placed into a wide-mouth bottle and *alcohol* poured on it. It should be shaken from time to time until all the shellac is dissolved. This varnish is made thicker or thinner by the addition of more shellac or more alcohol A stock bottle of it should be kept, and into a smaller bottle, fitted with a good cork (or preferably with a ground glass cover, fitted to the *outer* lip of the bottle), and a brush, a portion should be kept for constant use.

The impression (either partial or entire) is now coated with a thin solution of shellac varnish, and laid aside to dry. It is next coated with sandarac varnish.

SANDARAC VARNISH.

This is made like the other, only using *gum sandarac* instead of gum shellac. As there are, however, quite a quantity of little sticks, bark and other foreign matter in the globules of this gum, a little different manner of procedure, to make this varnish, will be indicated. The alcohol having been poured on the gum, it is shaken for two or three days (or more), until the gum is dissolved. The varnish thus made is now strained through some muslin to free it of foreign matter. Like shellac varnish, it may be made thicker or thinner by the addition of gum or alcohol; and like it also, it should be kept in a stock bottle, while that needed for constant use kept in a smaller wide-mouth bottle, fitted as indicated for the other varnish.

The impression having been coated with this varnish leaves the surface with high gloss which is imparted to the face of the model. Before the plaster of Paris is poured into the impression it is a good plan to put a pin, from which the head is cut off, into the depression of each tooth. This materially strengthens the teeth on the plaster model, and, besides, serves as a guide to replace them in their exact position when they are broken from the model by accident, or broken off purposely for the more easy removal of the model from the moulding sand, when a die has to be made.

The impression being varnished and prepared as described with a pin in each tooth (the heads of the pins being cut off), it is placed in a basin of water and allowed to soak while the plaster is sprinkled on the water for making the model. The water is then well shaken from the impression and the plaster poured in little by little, beginning at one side and going gradually around until all the depressions are filled without air bubbles. The plaster may be mixed a little thin, for as there will always be some water adhering to the impression, this will thin it and render the

flow even and smooth. The pins for the purpose advised may be purchased at a trifling cost (about 2 cents a paper). The heads, with about an eighth of an inch of the pin, should be nipped off with *the cutting nippers*, and kept in one box. They are useful in pinning down metal chamber patterns to the model when doing vulcanite work. The remainder of the pins should be kept in another box for the use already described.

The plaster of Paris should be kept in a box to which there is a lid for the purpose of keeping it dry. A small *tin scoop* is convenient to have in the plaster box to remove the plaster from the box to the bowl.

Several bowls, of about a pint capacity, should be on hand, and a *teaspoon* and *spatula* will be found useful to convey the plaster from the bowl to the impression, as well as to build up or form the model to the desired shape. Should there be any plaster left in the bowl after making the model, it is preferable to let this harden in the bowl (except this be in great excess); for when it is thus hardened it is more easily removed from the bowls by simply immersing them in water, which causes the plaster to flake away or separate from the sides and bottom of the bowls.

A water bottle is convenient to have on the plaster bench. It may be fitted with a cork in which there is an outlet to let a small quantity of water pass out on being jerked or shaken, for the purpose of thinning the plaster, should it have been mixed too thick.

A slab of thick glass is also handy, whereon to invest small or large pieces of work for soldering, or to build up or form a model into shape for easy draft from the moulding sand. This slab should be about four or five inches square, and about 3-16 to ¼ of an inch thick.

A plaster knife will be needed to trim and dress the model into the proper shape for easy draft from the moulding sand, as well as for other uses

A convenient arrangement to keep these last-named tools in place is a piece of tin or sheet brass plate, about three-quarters of an inch wide, bent into slots of sufficient capacity to hold the blades of the knife and spatula and the handle of the teaspoon This is tacked against the edge of the plaster table and serves as a receptacle wherein each of these tools is kept in place. The cut, Fig. 5, illustrates the arrangement.

For metal work the model is made thicker than for vulcanite work. When the plaster that has been poured into the impression and added to it, to give it the necessary thickness, indicates that it has begun to set, the slab of glass is gently laid on it and the whole reversed so that the impression cup will be uppermost, when, with the plaster knife or spatula, the model is formed in the shape of a cone, that it may part readily from the moulding sand when a die is to be made from it.

TAKING PARTIAL IMPRESSIONS WITH PLASTER OF PARIS.

It has been said with truth, "That the more difficult an impression is to take the more the necessity exists to take such an impression with

plaster of Paris." We have seen some really fine pieces of partial artificial work, as far as the workmanship was concerned, utterly useless to the patient, because the impression was taken with wax or modeling compound. It is not merely the dragging of the material around the teeth,

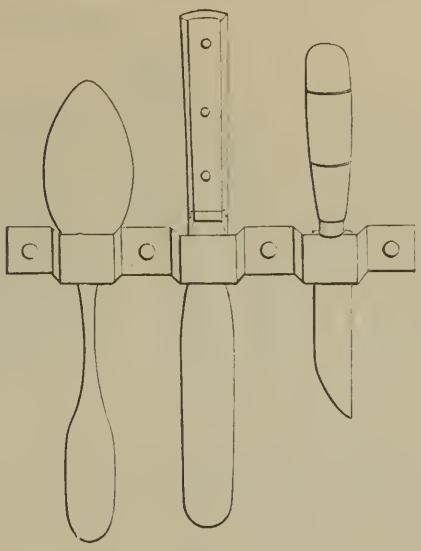


Fig. 5.

but there is no *certainty* but it may be bent out of shape in removing it from the mouth; hence the reliability of plaster of Paris, though it may be broken in a number of pieces in being removed from the mouth.

Fig. 6.

To overcome this liability of the plaster breaking *in a number of pieces*, Dr. Bennet offers the following valuable suggestion: The impression cup is warmed and prepared with narrow strips of base wax, as shown in Fig. 6. The cup is then *oiled* and the impression plaster put into it, and the impression taken. When the plaster hardens, the cup comes away, leaving the plaster adhering to the teeth. The pieces of wax that were stuck to the cup remain in the impression and serve as guides where to cut away the impression. A knife may be used to cut away this wax, as shown by

Fig. 7. And the impression being thus weakened by the cutting, may be removed in not more than *five pieces*. These are readily replaced into the impression cup, which it exactly fits, and a model made from it the exact counterpart of the gums and teeth.

After the impression has been repaired and varnished, we make a lather of soap and water, and with a small camel's-hair pencil, used with this lather, we paint the impression all over its inner surface and into the depressions of the teeth. We then put it into a bowl of clean water and let it soak until all air bubbles from the plaster impression cease to rise from it. We then pour a stream of water into it to wash out any of the lather that may remain in it, after which we shake out all adherent water, and then put the pins in the depressions of the teeth, when we fill the impression with *model plaster*.

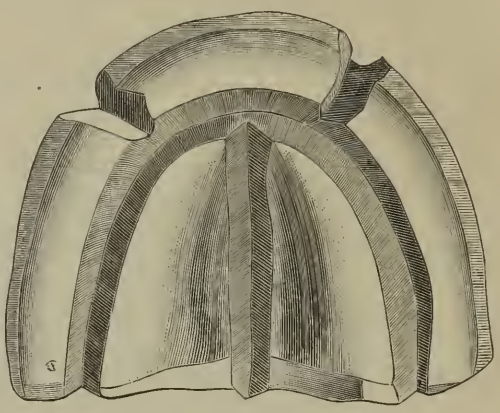


FIG 7.

To remove a plaster impression from the model, the impression is generally destroyed—always destroyed when it is an impression where some of the natural teeth remain. Sometimes the impression plaster is colored so as to show the difference between it and the model. In cutting the impression away from the model great care has to be observed lest the knife slip and thus mar the model. In doing this it is always best to let the thumb rest against the impression as a guard while the knife is pressed, removing little by little at each cut, until the whole impression is thus removed piecemeal.

The model being removed from the impression, it is trimmed into shape with the plaster knife. It is then coated with shellac or sandarac varnish. Should it be a partial case where clasps are used to sustain the plate, the clasps are bent first and accurately fitted to the teeth they are intended to surround. For the easier delivery of the model, in partial cases, from the moulding sand, the teeth may be carefully broken off from the model and laid aside; the pins used in the impression for strengthening the plaster teeth serving as admirable guides in replacing them when they may be cemented again in place after the dies are made.

For readjusting the teeth which were broken off from the model (in order that it might draw easily from the moulding sand), a Russian dentist recommends the following cement: 2½ grains of gum mastic (globules) and one grain of paraffine, to be molten together and made into sticks. The parts should be slightly warmed and a thin coating of

the cement softened by heat and put on both of the broken surfaces.

Liquid celluloid, made by dissolving small pieces of an old celluloid plate in equal parts of ether and alcohol serves this purpose also.

In the absence of either of the above, the adhesive wax, of which a formula is given on page 8, will also be found serviceable.

CHAPTER II.

For making dies and counter-dies *Zinc* and *Lead* are mostly employed. There are other compounds used, but these are the metals that yield the best results. For some time past we have used Babbitt metal according to the formula given by Dr. Haskell with very satisfactory results. The advantages of this metal consists in its being very hard, not cracking under the blows of the hammer in swedging as readily as zinc, in its melting much more readily than zinc, and in the still greater advantage that when the plate is swedged to fit the die, it will fit the plaster model as well, which cannot always be said of zinc dies. The manner of making this metal according to Dr. Haskell's formula is as follows: Copper, 1 part; Antimony, 2 parts; Tin, 8 parts. The copper is melted first in a crucible, and when melted the antimony is added. The tin may be melted in an iron ladle separately, and the other two metals poured on it. It is then cast into ingots and then remelted so as to have the metals well incorporated. A portable forge is necessary to melt the copper, as this takes a strong heat; while the antimony takes more heat to melt it than zinc. Once the alloy is made it then melts at quite a low heat, lower indeed than lead, so that in using a metal for the counter-die, tin has to be added to the lead to still further reduce the fusing point Dr. Haskell gives the proportions for the counter-die as follows: 5 parts of lead to 1 part of tin. The counter-die should be poured when nearly cold, and the die should be painted with whiting and water to prevent the adhesion of the two.

For melting zinc or lead, cast or wrought *iron ladles* are required. These are made with fixed and detachable handles. Either have their advantages but the ladles with detachable handles have the advantage of occupying less room. Such a ladle can be placed in a furnace and lifted out by inserting the handle in the slot when the metals are fused. *Two of these ladles* will be necessary, one for zinc, and one for lead, and great care should be observed in not permitting the metals to be mixed, as also in not allowing them to be over heated, which spoils the zinc, particularly. If Babbit metal be used for dies, a separate ladle should be used for it, and another for the counter-die metal. A simple blast furnace may be employed for melting these metals, but in lieu thereof, an ordinary cylinder stove, such as is used for heating purposes, answers well. When a good pressure of illuminating gas may be obtained, there are some large Bunsen burners made according to patterns of Mr. Fletcher, of England,

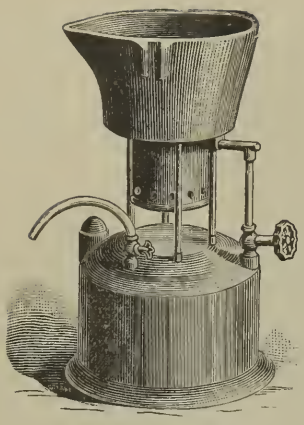


FIG. 8.

and made in this country by the Buffalo Dental Manufacturing Co., which with a sheet iron jacket and cover may be used also for melting zinc. A still better appliance (but more dangerous) for this purpose is the gasoline furnace. It is extensively used by plumbers for melting lead or solder. It does the work of melting zinc very promptly and the cost is nominal. But the exceedingly inflammable nature of gasoline, which is used in it, makes it undesirable, unless the melting process be carried on in the open air, as well as the gasoline (kept for replenishing the furnace), be also kept outside of the household. Fig 8 represents this furnace.

Casting rings should be had for obtaining impressions in the moulding sand, from the plaster model. These may be made of wood but are preferably made of iron, or still better, of copper which are more cleanly not being affected to rust by the moisture of the moulding sand. To make these dies and counter-dies, a separate table or bench is used, and no better arrangement for this work can be constructed than the one suggested by Dr. W. H. Trueman and illustrated in the recently published work, "American System of Dentistry" from which I make a copy.

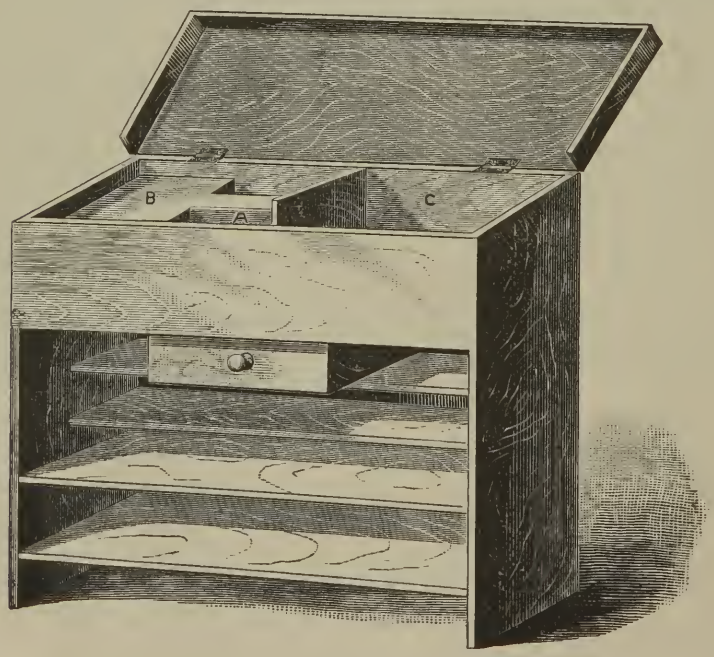


FIG. 9.

Dr. Trueman gives the following description of it: "The box is divided into two compartments, and it is lined with sheet copper. The compartment on the right hand (C,) is for damp moulding sand ready for use. The left hand compartment contains a fixed block (A) placed in the front right hand corner, the face of this block is about six inches square and about an inch below the edge of the box. On this the moulding is done. The remaining portion of this compartment is covered with a movable cast-iron tray (B) on which the moulds are set when ready to pour. After the sand has been used it is passed into the box beneath through a square hole at the right hand corner of the tray. By this arrangement the wet and the dry sand are kept separate, and the the tray is not kept encumbered with the sand that has been used. The tray being made of cast iron, is not injured by the heat, and any metal spilled upon it is readily recovered. It is very desirable in moulding that the moulds already made shall not be injured or shaken by the manipulation necessary in making others. It often happens that the sand is broken away, yet is not so much displaced that it may be accurately readjusted and a good cast obtained from it. In these cases a very little shaking would ruin the mould. In the bench referred to this is provided for by doing all the moulding on a solid block that is not directly connected with the tray on which the flasks are placed for pouring. Underneath the box is a drawer in which the tools used in moulding are kept, and underneath this, forming a stand for the box, are some four strong shelves, covered with sheet zinc to prevent wear, on which the flasks, new and old dies, zinc, lead, etc., are kept.

The tools used for moulding are *a sieve* made of fine brass wire; *a small brush* like a paint brush to brush the sand off the dies; *a spatula* to smooth the sand from the top of the casting rings; *a glass tube* or old blow pipe to blow out small particles of dry sand that may have fallen into the mould; *an iron spoon* to clear away the dross which collects on the top of the ladle of melted metal and to prevent it from being poured into the mould; *a small hammer and a small cold chisel* will be all the tools necessary for this part of the work

MOULDING.

The model prepared by being beveled and varnished and dried, is laid on the moulding block. A casting ring of proper size is selected and this is put over the model. The sand which has been moistened, but not made too wet (only moist enough that when a handful is taken and pressed it forms an adherent lump), is put into the sieve and sifted over the model encircled by the casting ring. After the model is covered with the sifted, moistened sand, the balance of the casting ring may be filled by simply putting the sand in with the hand, being careful that there are no large or dry lumps. The casting ring being thus filled without using any more pressure to pack the moulding sand than can be used with the fingers—for the

sand should not be packed tight or hard—the sand is made smooth with the spatula. The casting ring is now reversed, which brings the base of the model into sight. Should the sand around the edges of the model be found very loose it may be pressed by the fingers against the casting ring and against the model. The spatula is now used to remove any overhanging sand, by cutting this away carefully all around the edges of the base of the model. This being done the casting ring is taken in the left hand and reversed, holding the model so it will drop into the sand box. Should it not do so, a few light taps with the handle of the spatula or a light wooden mallet in the right hand, will dislodge it. Sometimes in pouring the zinc into the moulds it will be found to bubble. This is caused either by the sand being too wet, or by its being packed too tight. This may sometimes be avoided by taking a knitting needle and passing this through the sand, at some unimportant point towards the heel of the mould, and then elevating the casting ring by placing two old excavators beneath it, so as to allow a vent for the steam to pass out, or a much better plan will be to let the impression in the sand, dry well over the furnace, when the metal may be poured without fear of bubbling. Before pouring the zinc, the dross which collects on the top of the ladle should be removed or held back with an iron spoon, so it will not pass into the mould.

It is desirable in very deep mouths or high arches to make heavy dies, that will stand heavy hammering. This may be done by having a casting ring of the same size as the one used to make the mould, and when the mould is poured full, and when the metal is observed to begin to chill, to lay this edge to edge on the other casting ring and pour the remainder of the zinc into it. In this way quite a strong heavy die may be made. If the case be hurried the dies may be chilled, so as to make the counter dies at once; but it is preferable to let the metal cool down gradually.

The die being made, the face of it is painted all over with thin whiting and water and left to dry. The die thus prepared is now laid on the table, face uppermost. Moulding sand is now banked up all around it so as to form a kind of terrace, leaving only so much of the face of the die (or a little more all around) exposed as will be covered by the plate. A casting ring is placed over the face of the die resting on the sand terrace that has been banked up. More sand is now carefully put around the outer edges of the casting ring to prevent the escape of the melted lead when it is poured on. The lead should not be too hot, otherwise it may adhere to the die. The object of painting the face of the die with whiting is to prevent this, yet, despite this precaution, the metals will adhere if the lead is poured on too hot.

There is a simpler way of preparing the die so that the counter-die is made with less trouble, but we do not think that a plate can be so well swedged as by the plan above described. It might be well to prepare the best die in the manner described for the final swedging, and the others in

the manner which will be set forth. After the mould has been made as already described, take the casting ring in the left hand and invert it. With the spatula in the right hand, dress away carefully all the sand in the ring to about a half or three-quarters of an inch from the edge of the casting ring, leaving the casting ring bare, as shown in the cut, Fig. 10

FIG. 10.

When the zinc is poured, it will fill all over the face of the mould and up to the ring where the sand has been dressed away, as shown by cut, Fig. 11.

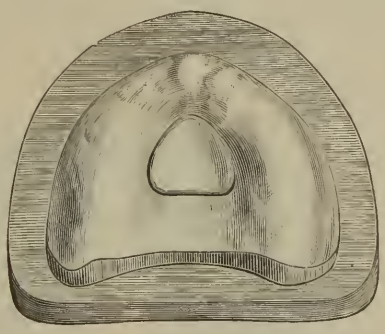


FIG. 11.

To make a counter-die for a die thus constructed, place the die, when cold, within the casting ring, as shown in Fig. 12, painting the face of the die with thin whiting, and pour the lead upon it. Do not let the lead be too hot.

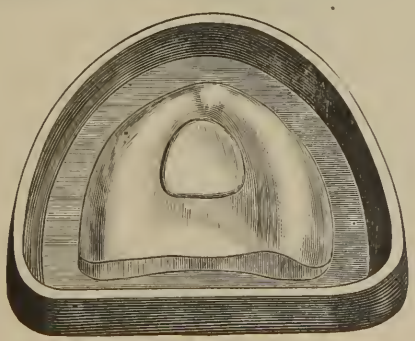


FIG. 12.

The objection to this form, is that in swedging, as much pressure is made against the square shoulders of the die and counter-die as on the plate that is being swedged, whereas in the other plan all the pressure is brought against the plate. This objection may be overcome as follows: When the die is made, as shown in Fig. 11, place it within the casting ring, as shown in Fig. 12. Before pouring in the lead to make the counter-die, fill in some moulding sand all around the shoulder of the die to the depth of about one-eighth of an inch, then pour on the lead. When the lead counter is made in this way the shoulders of the die and counter-die do not touch each other, so that in swedging the whole force of the blows of the hammer is brought against the face of the die. Fig. 13 shows the die and counter-die made in this way.

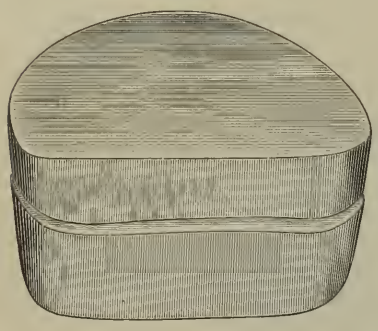


FIG. 13.

It is sometimes necessary to make a die more accurate than it is possible to obtain one from the moulding sand. In such cases the die has to be made in sections from the model. The sections are made with plaster mixed with powdered pumice stone, and when completed the parts are assembled, held together with binding wire, *thoroughly* dried and then the die metal cast into it. Fig. 14 shows such a sectional impression. Such cases are rare, because, as it is impossible to remove such a model from the moulding sand, so is it almost impossible to remove the counter-die from such a die. Yet it is well to tell how such a difficulty may be overcome.

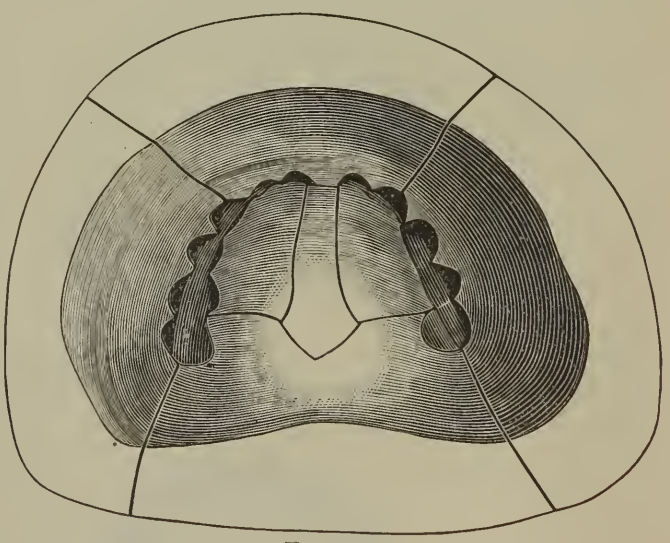


FIG. 14.

Should there be any zinc or lead left in the ladles after making the dies and counter-dies, the dross should be removed with the iron spoon, and what remains be permitted to cool *in the ladles* instead of pouring it out into any receptacle, for on remelting, for other cases, the whole force of

the heat will be exerted on the ladle and its contents instead of only on isolated old dies that may be put in for remelting.

The dies and counter-dies having been made as described, they are separated from each other, brushed and cleaned ready for use. All the tools are now wiped and put away, and the moulding bench cleaned and closed again until needed.

In making dies for partial cases, the remaining teeth sometimes stand in such relation to each other that it is impossible to withdraw it from the moulding sand perfect. When such cases are intended to be supported by clasps, the clasps are first bent to fit the teeth to be clasped; after this, it has been our custom to break off the plaster teeth from the model as close to the gum surface as possible. These teeth, with the pins that run through them, are laid aside carefully, and the die made as described. When the dies are made, the teeth may be replaced to the model, in exact apposition, by the help of the pins, and the two stuck together as firmly as if never been broken, by means of a little *Phosphate of Zinc*, mixed quite thin, or with the cements recommended on a former page.

SWEDGING.

The next operation is the swedging of the plate. For this purpose a pattern of the plate is made of what is known as pattern-metal. This is nothing more than a foil made of tin and lead, the two outer surfaces being tin, the inner lead. It is rolled quite thin, and is so malleable that it may be readily pressed with the fingers all over the surface of the die. This being done, it is cut into the shape of the future plate (slightly larger, to allow for variation in swedging) with the end of the sharp blade of a penknife This done, it is carefully flattened and laid on a piece of gold or silver plate and its form traced thereon with any sharp point. The plate is then annealed. To accomplish this, it is laid on a piece of charcoal and the blaze of a spirit-lamp (or gas blow-pipe, which is preferable) is blown on it with the mouth blow-pipe until it is red-hot. It may be plunged in water to cool, which does not seem to harden it. We have been told by an operator, who does considerable plate work, that if the gold plate when it is annealed is thrown or plunged into alcohol, it will be made much softer, and consequently more easily swedged.

A very handy adjunct of the laboratory is a piece of *charcoal for annealing*. This may be made neater by sawing a piece square from any good close-grained block of *pine charcoal*. We say pine charcoal, as oak charcoal will not do. In the latter particles fly off into sparks when the flame is thrown on it, making it useless and very disagreeable for the purpose. The block should be cut about two and a half inches square by one inch thick. To have this handy without soiling the fingers a very nice receptacle may be made for it of a piece of sheet-iron, cut out like Fig. 15.

After this is cut out in this way a small hole is punched through it at the centre. An old excavator may be filed at the butt end of the handle

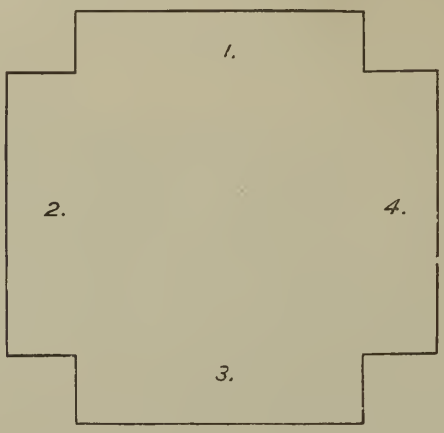


FIG. 15.

to a shoulder, until it passes through the hole. The piece of sheet-iron is now bent up at its sides (1, 2, 3 and 4) with a pair of large flat-nosed plyers until it forms a box. The filed end of the excavator may now be riveted to this iron box, and the tapering end of the excavator driven into a suitable handle The piece of charcoal can be set into this box, which makes a nice tidy appliance on which not only to anneal plate or wire, but also to solder small pieces.

The plate being annealed and cooled, it is held between the fingers and thumb of the left hand on the die, while with a *horn hammer* in the right it is hammered in an approximation of a shape, frequently annealing it to prevent its cracking. This operation is assisted by means of *the plate benders*, as also the *round and flat-nosed plyers*, being careful when using these not to mar or bruise the plate. In hammering up an upper plate, particularly a full upper, there is a clamp made which is quite serviceable. After the plate has been stretched with the horn hammer down to the die on the palate surface, it is cut at the median line with the *plate shears*. The clamp is now applied by clamping the plate as well as the die to the work-bench, putting a piece of soft paper or rag under the screw, so that this may not bruise the plate. All being firmly clamped down, the plate may be stretched over the front of the ridge by means of the horn hammer, while the plate and die are thus clamped. Fig. 16 illustrates the clamp.

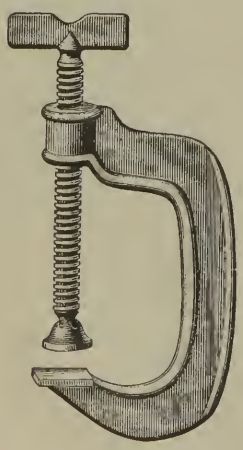


FIG. 16.

The plate being thus bent and hammered into shape, it is annealed before placing the counter-die on the die. When this is done it should

be gradually *coaxed up*, removing the counter-die from time to time to ascertain if the plate is being carried to its proper place; this being made certain by frequent examinations or corrections, the die may be driven home to its place. After each annealing of the plate, it is well to throw it into the pickle to clean it off.

It is well to make three dies and three counter-dies for each case, reserving the *best* of the three for the final swedging. To hammer up the plate into the approximation of shape, as above described, the *worst* of the dies may be used first, as the better dies, used for the final swedging, will correct any inaccuracies existing in the first dies used. The plate being thus roughly swedged is now cut into *nearly* its proper dimensions with *files* and *shears;* and in partial cases, where teeth remain, the *plate-cutting nippers* are handy for cutting out those semi-lunar places around the teeth. When this is done, the plate should be examined to ascertain if no lead or zinc has adhered to it before it is subjected to another annealing. If any is discovered it should be removed by means of a pointed soft pine stick, charged with fine pumice and water. Thus cleaned it may be annealed. A good plan to prevent the zinc or lead from adhering to the plate is to oil the die and counter-die with a thin film of oil before swedging.

The plate is now laid on the second die and the counter-die placed on it, and driven home as before. In swedging, a heavy hammer, weighing about six or seven pounds, should be used, and the *die* (not the counter-die) struck with this. The hammer should be held in the right hand by the handle, about three or four inches from the hammer-head. The die should be held with the left hand on an anvil, which should be placed on a block for the purpose.

CHAPTER III.

A piece of scantling six by six makes a good block on which to place the anvil; and to prevent the noise and jar of the hammering through the household, a piece of thick rubber—a half-inch thick—may be nailed or otherwise secured to the bottom of the wood, next the floor.

Fig. 17.

A jeweller's anvil, such as is shown at Fig. 17, is an excellent form to have on the block; but as these are expensive, a square 50 pound weight or a square block of iron 5 by 5 inches square will answer the purpose as well. Such a substitute for the anvil may be secured to the block by tacking a rim of sheet-iron around the top of the block to hold it in place.

The final swedging is concluded with the *best die*, and conducted in the manner already indicated.

Before each swedging the plate should be annealed, and while hot thrown into a jar of *pickel* (a solution of sulphuric acid and water, one part of acid to three parts of water), which cleans the plate off.

In making a die for an entire upper set, the location of the central air chamber (if the workman purposes to use an air chamber) is filled with a piece of thin base plate wax on the plaster model, and this is cut into shape with the warmed wax spatula and sharp knife blade. A film of sandarac varnish is painted over this wax air chamber and the model, to give it a smooth surface and to retain it in place. A die thus made has the central air chamber reproduced, and a plate swedged on such a die carries the imprint of the chamber on the plate. Fig. 18 shows the model prepared for making such a die.

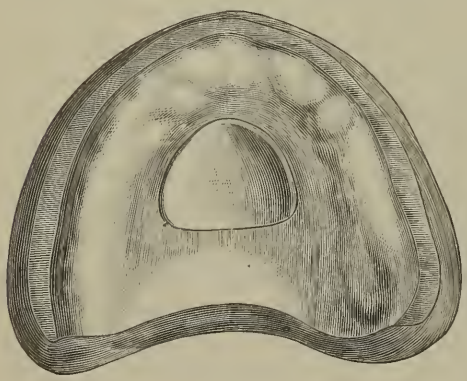


Fig. 18.

To make this chamber sharp and well defined we have made use of a piece of boxwood, or vulcanized rubber like the handle of a dinner knife, which may be sharpened on one end, and with it the plate is driven close up to the die at this point by hammering on it, better than it can be done with the counter-die alone. Such an appliance is shown at Fig 19.

When the end gets battered from hammering it may be re-sharpened. This kind of a chamber is called "a blind chamber." The adhesion is not as strong with this style of chamber as with the "Cleveland chamber," which will be described further on, as it cannot be brought so close to the gum as the other, nor does it present so well a defined edge to that tissue as the Cleveland chamber.

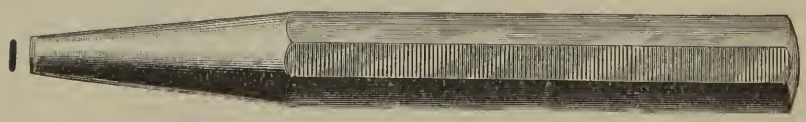


Fig. 19.

To make a Cleveland chamber the plate is swedged as described, after which the central part is cut out along the edge of the chamber next the

gum. There are *Plate cutters*, Fig. 20, made for this purpose, but we do

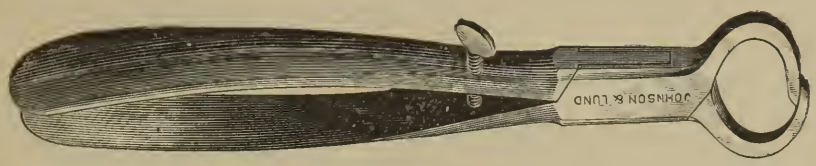


FIG. 20.

not recommend them as a useful tool for the laboratory. We punch a hole at a point in the plate at the circumference of the chamber with the *plate punch*; we next pass through this hole one end of a fine saw secured in the *saw frame* and tighten this up, and then saw out the chamber, putting a little oil on the saw while doing this. In this way the entire piece of plate may be saved and made useful for the rest of the work. The plate being thus cut, it is neatly and smoothly filed around the circumference of the chamber. It is again annealed and re-swedged. The piece of plate that was cut out is annealed and passed through *the rolling mill* and stretched until it is 28 in thickness of the *plate and wire gauge*. It is again annealed and passed through the rolling mill in the direction at right angles to the first milling until it is 30 in thickness. In this way it may be stretched or enlarged sufficiently to form the cover for the Cleveland chamber. This piece of plate is now swedged on the die with the rest of the plate in place. It is then traced with a sharp point so as to be even all around the circumference and filed up to the line traced upon it. This cover is then soldered to the plate. We do not, however, recommend this soldering to be done *immediately*, because, if the plate should *not* adhere, there are no good means of rectifying the misfit. It is better to secure the cover to the plate with adhesive wax and try the plate in, to see if it fits and adheres before soldering it. Should it not fit, a new impression may be taken, new model and die made and the plate *re-swedged*, which could not have been done if the cover had been soldered on, unless by unsoldering the cover from the plate, which would be attended with considerable trouble.

Another way, and perhaps a better and neater, of making a Cleveland chamber is to make a die from the model just as it is taken from the impression. When the plate is swedged on this, a pattern of the air-chamber is made out of a piece of brass plate of the proper thickness. This is then annealed and hammered on the die with the *horn hammer* until it fits the place pretty accurately. It is now placed on the plate and soldered to it with a *minute piece of silver solder*—a piece no larger than a pin's head is sufficient. The plate, with the piece of brass thus united, are now swedged together, the brass readily sinking into the lead counter-die. The piece of plate for the cover is swedged over this brass air-chamber. A hole is drilled through the plate near the edge of the brass air-chamber, and the piece sawed out in the manner before

described. The cover is soldered to the plate as indicated in the other plan. The cover can be swedged much sharper by this plan than by the other.

For starting a plate on a lower die—either full or partial—*the plate-bender*, Fig. 21, will be found quite serviceable. A piece of hard wood,

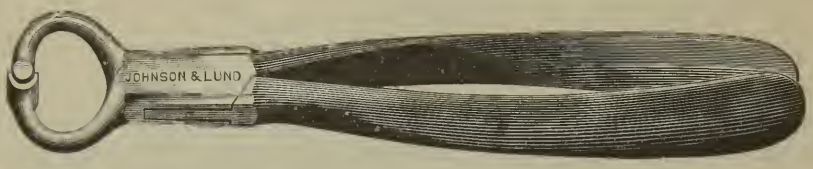


FIG. 21.

whittled at one end (like Fig. 22), so as to straddle the ridge while hammering it into shape before swedging, is also very useful.

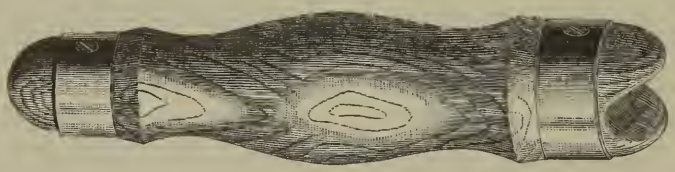


FIG 22.

In lower partial cases, where only the six or eight front teeth remain, it is customary to let the plate rest on and against the lingual surface of these teeth, as also to stiffen the plate by doubling it at this part, by swedging a thinner piece of plate over the first and soldering the two together.

In partial cases where clasps are to be used, it is best always to have not less than *two clasps*. When only one clasp is used, the plate is apt to sway down, and is never as steady as when two are used. It is better also, when practicable, to clasp *one tooth on each side of the mouth*, rather than two teeth on the same side.

Bicuspids and molars are always to be preferred to clasp, rather than cuspids. These latter teeth are badly shaped for clasps, and when used, the clasp has to be placed so much on the neck of the tooth, to get a grip, that this tissue is soon worn through by the constant rubbing of the clasp; especially where the enamel is thin.

A clasp should be bent around the distal part of the tooth, rather than around the mesial, so that it may be out of sight. It is admissible, however, to bend a clasp around the mesial surface of a molar or bicuspid, and in many cases it will be found to hold better and keep the plate more

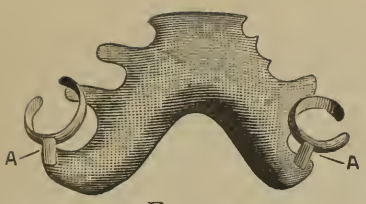


FIG. 23.

steadily in position. It is *never admissible* to file two sound teeth apart for the purpose of clasping. It is best always to clasp a tooth as high up *on its bulbous part* as possible, for in this position the enamel is thicker, and the clasp is less apt to wear away the tooth than if bent lower down near the gum margin. In cases where there is a great recession of the gum this is particularly indicated, and in order to unite the clasp to the plate a standard is used to attach the two, as shown in Fig. 23, at "A."

The plate, either partial or entire, being fitted, the bite is now taken.

In partial cases wax is placed over the plate and made to adhere to it by slight warming, particularly in the places where artificial teeth are to be soldered. It is then placed in position in the mouth and the patient directed to close the upper or lower teeth into the wax If there are any teeth that antagonize in the upper and lower jaw, it is easy to see if the patient has given the proper bite. It is always our custom in making a set of teeth in one jaw to take an impression of the teeth of the other jaw, and from this impression make a model. This being done, the model will fit exactly in the imprint of the teeth left into the wax on the plate, and the grinding of the artificial teeth be conducted more intelligently than if a dependence is placed merely on such a guide as may be given by running plaster into the imprint of the teeth left in the wax on the plate. The bite being taken, as described, the models are placed in *the articulator* by moistening them and adding plaster so as to unite them to the articulator. Some operators prefer the all-plaster articulator to those that are sold for this purpose. The manner of making a plaster articulator will simply be to add new plaster to the model, forming a heel or extension. When this has hardened, small depressions are made into the extension, and the whole is varnished, after which plaster is added to the other model (which was placed into the imprint left in the wax by the teeth) and filled into the depression made into the extension.

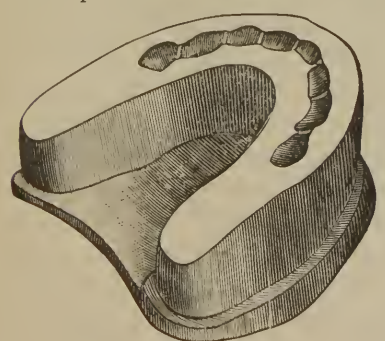


FIG 24.

For taking the bite for an entire upper set, wax is placed on the plate and trimmed to the proper thickness, size or fullness, and the patient directed to bite (gently) into the wax. The model which was made from the impression taken of the lower teeth is placed in the imprints of the lower teeth in this wax, and the bite, thus secured, is mounted in the articulator, as shown in accompanying cut (Fig. 24).

CLASPS.

For making clasps, gold alloyed with platinum is generally used, as it makes the gold tougher, more elastic and more springy than gold of which the plate is made. To make a clasp, the pattern of a tooth to be clasped is taken with thick tin foil (No. 60) or pattern metal. The metal or foil is carefully pressed around the plaster tooth of the model. It is then scratched in the place it is desired that the clasp should hug the tooth, and then cut to this mark with the very sharp blade of a penknife or the abscess lancet. This pattern is laid on the piece of clasp gold and its shape scratched on the gold; it is cut and filed to shape, and then bent to fit the tooth. Where the clasp is to be soldered to the plate it should be strongest, and the ends on either side of this point may gradually taper. Clasps are best bent with *round* and *flat nose pliers*. A pair of flat nose pliers from which the temper has been drawn and then have *one of the noses filed half round* and retempered will be found very useful for bending clasps. *The clasp-bender* is also valuable at times in making a nice fit in certain forms of teeth. See Fig. 25. Before commencing to bend a clasp the gold should be annealed so as to make it as easy to bend as possible. It is not necessary to fit the clasp to the plaster tooth on its posterior buccal or anterior buccal surfaces, as this may be done in

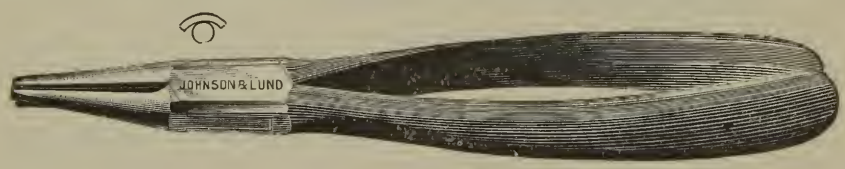


FIG. 25.

the mouth or when the work is completed; besides, if this be done, it will often be found very difficult to remove the clasp from the plaster tooth when it is united to the plate with adhesive wax prior to investing and before soldering. There are some positions of the teeth and plate, where this is so difficult that it is not safe to rely on adhesive wax, for fear of its bending or yielding in removing the clasp from the model. In such cases we prefer to use gum shellac to unite the clasp to the plate. Should this break in removing, the fractured parts may be replaced in exact apposition and so held, when a little adhesive wax (which will not melt the shellac) can be dropped on the fracture and held in place until this cools, which will enable the operator to invest the parts in their exact relation. Another means of getting over this difficulty is to complete the bending of the clasp to the tooth *in the mouth*, then place the plate in position on the gums. *A plaster impression* is now taken of the plate and clasp in position. This is removed and plaster and sand run

into this impression. The impression plaster is then removed, and the clasp and plate united by soldering. This is a more certain way of procedure.

In bending a clasp, when even the most scrupulous care is observed, the constant taking off and putting on of the clasp, to see that it fits the tooth, will wear away the plaster tooth. A very good plan to overcome this wearing is to take an impression of the tooth to be clasped in *mouldine*, and into this impression cast a die of fusible metal. A clasp can be bent very accurately to this metal form, without in the least wearing it away.

Where, from the peculiar shape of the tooth, a clasp must be bent to fit with great accuracy, it may be accomplished as follows: An impression of the tooth is taken from the model (either entire or in sections), with plaster and powdered pumice. This is thoroughly dried and a die made *into it.* A counter-die is also made. The clasp is bent with pliers as nearly perfect as possible, and then annealed. It is then placed in proper position *in the counter-die* and swedged to proper shape with the die. Fig. 26 illustrates a die to swedge up a clasp accurately.

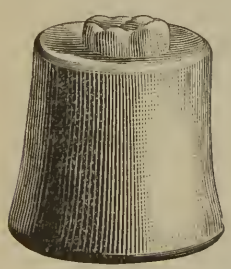


Fig. 26.

A *crib clasp* is sometimes used in the lower jaw to prevent the plate from pressing down and wounding the gum. It consists of a piece or pieces of metal united to the clasp and resting on the masticating surface of the tooth. To make a crib clasp a die and counter-die are used and made in the manner above described, if the work is desired to be particularly neatly done; although it may be done without the die and counter-die.

Soldering.

This operation requires considerable skill and practice. The one rule however consists in heating the work *thoroughly and evenly throughout not in one place only.* The plaster investment, the plate, the teeth and clasps should *all* be heated to such a point that the solder is *nearly* ready to melt, when the flame is pointed (as it is termed) to cause the solder to flow evenly and smoothly by the concentration of the heat. In soldering clasps to the plate, it is best to file away the plate at all points except at that point where it is intended to unite it to the clasp. At this point it should be fitted *close.* Indeed close fitting is one of the principal secrets of successful soldering. If it be impracticable to do this, by painting the clasp and plate with thin whiting and water at the parts it is desired that the solder should *not* flow, the same object will be gained; but this must be carefully done *as solder will not flow where there is whiting.* It is a bad plan to let the solder flow all around, and then use a fine saw to sep-

arate the plate from the clasp at points where it is not desirable for the two to be united. Formerly soldering was done entirely by *the mouth blow pipe. The self acting blow pipe* was at one time much used to heat the work up thoroughly. It consisted of a tight vessel, from which a tube extended, and passed near to the flame of the soldering lamp. The vessel was partly filled with alcohol and this was boiled by means of a small blaze attached to the soldering lamp. The vapor thus generated and expelled through the nozzle exerted a strong blast against any object

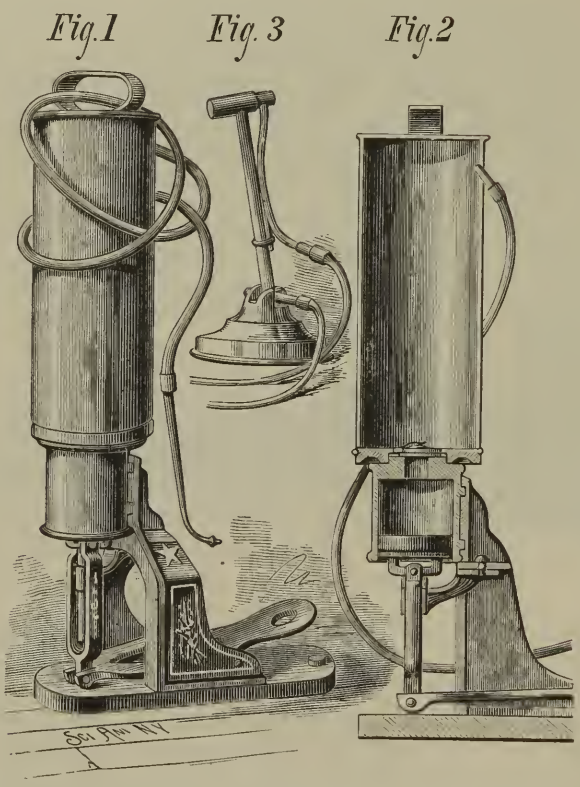


FIG. 27.

at which it was directed. But pointing the blaze was impracticable with this instrument. The Burgess Blow pipe, FIG. 27, is a most excellent device for soldering. With it the blast is under entire control of the operator and the most powerful blast, or the finest pointing of the blaze, may be exerted at will. We prefer, however, to all other devices for soldering, *the gas blow pipe and bellows* designed by Mr. Fletcher, of England, and shown in the following cuts, FIG. 28 :

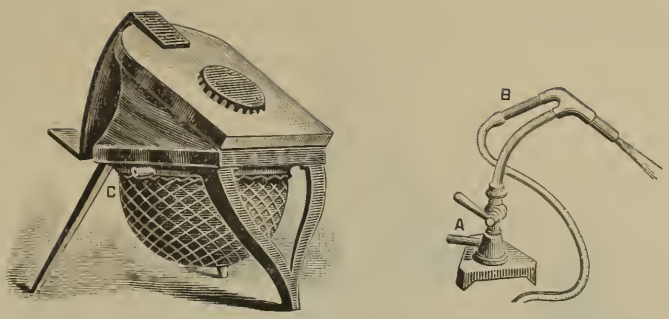


FIG. 28.

This device is used with illuminating gas. The gas is conducted to the blow pipe by means of flexible rubber tubing from any burner to the tube A of the blow pipe, while another tube is placed at B which is used with the mouth for small or light work, or the same may be connected with the tube of the bellows at C for large or heavy work. The handle or lever just above the gas supply tube A, controls the flow of gas, and the size of the blaze, so that a large, small or pointed blaze may be at any time directed against the work. With this blow pipe, soldering a full set of teeth may be done with comparatively little fatigue. The work is merely held against the blaze while the blast is increased or diminished by means of the foot exerted on the bellows, or by means of the lever on the blow pipe being opened or closed to admit a larger or smaller supply of gas. The right hand is untrammelled, so that any refractory piece of solder may be pushed into place by means of a suitable instrument for this purpose, mounted in a wooden handle, and directed with the right hand. But by the close fitting of the parts, no aid of this kind will be needed, other than the well-directed pointing of the blaze.

The soldering pan or furnace, FIG. 29, was at one time extensively used as a means for holding the work while it was being soldered, as well as for heating it up preparatory thereto It is an excellent device for the purpose, although rather cumbersome and unwieldy. A few pieces of ignited charcoal are put into the bottom of the pan and more added until the receptacle is nearly full. The piece of work invested and ready for soldering is now laid on, and more charcoal, in small pieces about the size of "a filbert," are filled in, all around the work, and a large piece is laid over the work, and the cover put on. The little door is opened to admit the draft, and the device set one side for all the charcoal to kindle By the time the coal becomes a glowing mass, the work will be so thoroughly and evenly heated that it will require only a slight blast from the blow pipe to fuse the solder evenly and smoothly all over the work. The disadvantage of the device consists in its size as well as the large body of

glowing charcoal which must necessarily be held near the face during the

Fig 29.

operation. *The carbon or asbestos block*, Fig. 30, is intended for the same purpose as the soldering furnace; but we doubt, even with the disadvantages mentioned, whether the soldering furnace is not the better of the two devices. When the work is invested and ready for soldering it is

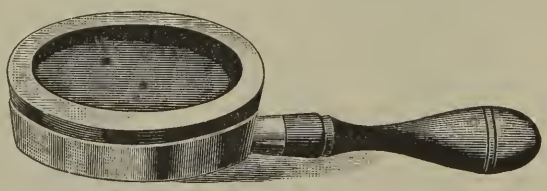


Fig. 30.

placed over the basket or the spider, on the bunsen burner shown in cut Fig. 31, the gas is ignited, and the work is allowed to heat up thoroughly,

Fig. 31.

when it is removed, with a pair of *long soldering tongs* to the carbon block, and there subjected to the heat of the gas blow pipe necessary to fuse the solder.

On the subject of investment we have a word to say: *Fine sea sand*, *powdered pumice stone*, or *powdered marble dust* are recommended, to be mixed with the plaster of investment for the purpose of preventing the investment from cracking when subjected to heat. *Asbestos*, is also recommended for this purpose. But despite the use of these, and the most careful and even heating of the case, the investment will often crack or spread, thereby causing a misfit, which is irremediable, after the work is entirely completed. To meet such a misadventure we have for some years used the following device, FIG. 32:

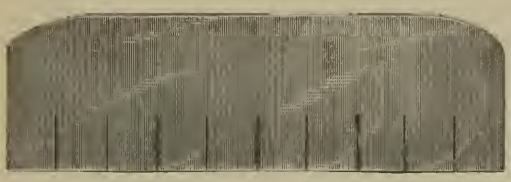


FIG. 32.

A piece of sheet iron similar to what is used for stove pipes, about 1 ¼ inches wide by 5 inches long is nicked with the plate shears, as shown in the cut, after which it is bent in a horse-shoe form with the nicked parts bent under as shown in FIG. 33. When the case is ready for investment, the plaster is mixed with either sand or powdered marble dust as also some fine asbestos cut very short in small pieces.

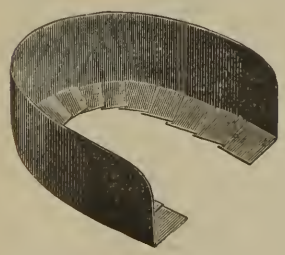


FIG. 33.

We do not, however, favor marble dust as one of the materials for investments as it forms with heat a kind of slag which is very difficult to remove from the work, adhering sometimes very firmly to the mineral teeth. There is a great selection in asbestos for mixing with plaster for investment purposes. Some is very coarse, with hard pieces almost as rigid as pieces of stick, while other selection of this material is soft, free from rigid particles, and as flocular as sheep's wool. *The latter* is the best for investments, but even in this form it should be cut up with a pair of scissors into small particles so that it will mix readily with the sand and plaster, and when these have all hardened, admit of being trimmed with a knife in the proper way before soldering. A form of asbestos called "Powdered Asbestos" is now procurable, which is the best form in which to use it, as one of the materials for investments. The case, as we have said, being ready for investment, the plaster, sand and asbestos in equal proportions are mixed with water. The device, FIG. 33, is laid on *a glass slab* and some of the investment is plastered all over the inside and over the bottom part of it, where it was nicked. The investing plaster is also filled, in the inner part of the plate, and over the labial surfaces of the teeth. The plate is now taken at its back part, near where it adjoins the soft palate, with a pair of solder tweezers, turned over and laid into the plaster previously placed in the device (FIG. 33).

The investment should be brought up, well over *all the teeth*, and well over the suction chamber, permitting only so much of the plate to be exposed, as is necessary to flow the solder over it, from the backings of the teeth. All *sharp angles* or *deep depressions* should be avoided when trimming the investment, otherwise the heat which is exerted from the "pointed flame" will be reflected from the point where it is desirable to have it in its greatest intensity.

CHAPTER IV.

The great secret of soldering is even heating, gradual heating, thorough heating, and *close fitting*. It is often found that (as for instance in soldering a clasp to a plate) though the clasp may fit the tooth ever so perfectly, and though the plate may fit around the clasp ever so accurately, that after the two have been soldered, the clasp will stand away from the tooth, or the plate sprung away from the investment. The disposition of all young workmen is to get the case soldered *as soon as possible*, and to this is due the error which is certain to occur if it is attempted to make the solder flow before the case has been *slowly, evenly* and *thoroughly* heated. The investment and plate should both be glowing red hot; not so hot, of course, as to endanger the melting of the plate, but still the whole work so hot that the solder is almost ready to fuse before the flame is thrown on it. The flame should not be directed against the plate until all has been heated glowing red hot by the conduction of the heat *through the investment*. If the flame is thrown on the plate, *uneven* heat will be exerted, and the plate will warp, or the clasp draw away from the investment, and in this case there is nothing to do but to saw off the clasp, readjust the plate, which is often extremely difficult, file off the solder, wax on the clasp again with adhesive wax or shellac, reinvest and resolder. In heating up a case then, never throw the flame *on the plate* until all the work has been heated red hot *through the investment*. Blow on the investment constantly until clasps, teeth, backings, and plate are so hot that it will only require a momentary blast, with the flame pointed, to have all the solder melt evenly where it is wanted. Another great aid in soldering is *the close fitting* of the parts. It is needless to expect the solder to *bridge over spaces* that have been badly fitted. To this cause is due the drawing away of clasps from the investment as much as irregular heating, not to speak of the greater difficulty of making the solder flow over such badly-fitted joints. It is a source, too, of warpage; for as more solder than is necessary is used to bridge these places, the shrinkage, when the solder cools, must draw the softer or more yielding metal, of which the plate is made, out of place. When spaces exist between the backings of the teeth and the plate from bad fitting, or any accidental cause, it is best to fill these spaces with gold foil by packing them full, so that the solder may flow over these places without difficulty.

The plate being swedged, the teeth are then ground and fitted to it. To do this a rim of wax is placed over the plate and the tooth put in the position it is to occupy on this wax according as the position is indicated by the bite on the articulator. The tooth is then ground to fit against the plate in its proper position by means of *small corundum wheels* attached to the spindle of *the grinding and polishing lathe*. These corundum wheels cut better if they are kept well moistened while they are revolved in the lathe, and for this purpose *a lathe drip* is a convenient and necessary adjunct to this part of the work. We know of no better arrangement that may be made for this purpose than an old "Student's Lamp." The part that holds the wick on chimney is readily filed off, when a small faucet can be soldered to the tube at the point cut off, and thus the flow is easily regulated and made to drip on the sponge against which the wheel turns. These old Lamps may be readily had at any second hand dealer's or auction for a very nominal cost. Fig. 34 illustrates the device. The drip being placed on the table of the lathe the faucet is turned and the water flows from the tank A, in such volume as it is needed.

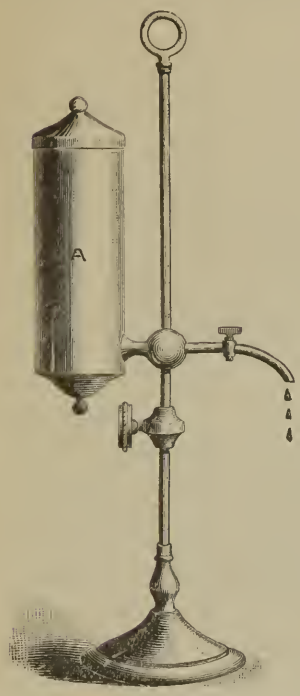


Fig. 34.

A square pan, preferably made of sheet zinc, is laid on the table beneath the grinding wheels to catch the dripping from the faucet. This should be about 6 or 7 inches square by one or one and a half inches deep. A piece of board, a half-inch thick, may rest on this pan to afford a support or rest for the hand while holding the tooth to be fitted. If the water is permitted to drip directly on the stone it is thrown off by the revolution of the wheel and splashed in the face or over the clothing. To avoid this the wheel should turn against a piece of sponge. We have tried many devices for this purpose, but the one that we have settled on gives the most satisfaction and is easily made. Procure an old iron *three-pronged fork*. Remove the bone or wood handle from it. Fill a large casting ring full of moulding sand. Let this be packed in tight. Now take the *prong part* of the fork and sink it into the moulding sand below the part where the prongs diverge from the shank. Level off the sand with a spatula and place a small casting ring over that part of the fork that sticks out of the sand. This small casting ring should be placed in this position *inverted* so that the small part of it will be next the moulding sand in the large ring. The edges of this small casting ring are then

filled around the outside with moulding sand, to prevent the escape of the metal which is to be poured in. Lead is then melted and poured into the small casting ring. This flows around the shank and holds it fast. When it cools an appliance such as is shown in Fig. 35, is the result. A piece of sponge is readily stuck on the fork, and the weight of the lead base which is cast around it not only holds it steady against the revolving wheel, but materially steadies the light sheet zinc pan into which the dripping water falls.

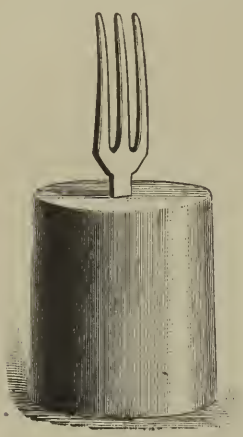


Fig. 35.

The teeth being all ground and fitted to the plate, it is our custom to make a plaster matrix to hold them in position. This is done by countersinking several holes in the front part of the model and then varnishing. This is then oiled and plaster poured into these countersunk places as well as over the outer faces of the teeth. The plaster being set, the wax is removed from the pin surfaces of the teeth and the teeth are backed or lined with gold or silver plate, according to which of these metals is being used.

In backing the teeth *a pair of plate punches* will be needed. It is a good plan to mark with a lead pencil a line just above the upper rivets on the tooth, all around, so that all the backings may be of uniform height. A strip of metal being taken the width of the tooth, a hole is punched into it. One of the rivets in the tooth is put into this hole and a twisting motion given to the tooth, pressing it, while doing this, against the strip of metal. This leaves a mark where the other hole is to be punched. This being done, the metal is laid on the tooth, and with a sharp point it is scratched to indicate any overhanging parts of the strips of metal backing. The holes are then countersunk to allow the pins or rivets of the tooth to fill in, and hold firmly to the backing. The backing may be made to go up even with the cutting edges of the teeth or they may be fitted rounding. We prefer the latter form, as we think more translucency is given to the tooth by not covering the entire back with gold. It is well to chamfer the edges of the backing to avoid bulk, as also to give it a concave form so it may lie close to the tooth at all points. To accomplish this the backing may be struck on a piece of lead, with a large ball, *plate burnisher*, or it may be bent at its entire circumference with pliers into this form. Lay the tooth with the backing in position on a block of lead, on which a small piece of wax was put to make a kind of bed for the tooth, and use the rivetting hammer to rivet the pins to the backing. In rivetting, the elbow should be pressed against the side of the body and the rivetting hammer held so that only the wrist moves. By observing this, the end of the hammer will always strike the rivet, and thus avoid the liability of breaking the tooth.

After the backings have been rivetted to the teeth they are filed and fitted so they will lie close to the plate, to which they are afterwards to be soldered. Many operators prefer, instead of making a plaster matrix, to invest the teeth at once, and take the teeth from the investment one by one and then back them. But we have found by this plan (especially with the molars and bicuspids) that a large part of the investment has to be cut away, in order that the tooth may be released, and by so doing these teeth are not held as firmly in their position as by the plan we have advised, and are apt to tip inwardly during the process of soldering. When all the teeth are backed, they are gummed to their places with adhesive wax. The matrix is removed and the case invested as has already been described to prevent the cracking of the plaster investment when soldering. Page 31. When the investment has hardened, *all the adhesive wax* that was used to gum the teeth to the plate, must be scraped off *perfectly clean*. The backings and plate, where it is intended the solder is to flow, must be scraped *absolutely clean* and bright, when the case is ready for soldering. This operation has already been described. Before soldering the case, *powdered borax* mixed with water on the solder box (an illustration and description of which has been given at page 7) to a creamy consistency is painted with a small camel's hair pencil, all over the backings and over that part of the plate where the solder is to unite the teeth to it. It is then placed in the soldering furnace (Fig. 29, page 30) or on the spider of the bunsen burner (Fig. 31, page 30) where it is allowed to heat up thoroughly before removing it to the carbon block (Fig. 30, page 30) for soldering.

The case being soldered, is allowed to cool down gradually. When cold, the investing plaster is removed and the case boiled in *a solution of sulphuric acid and water*, in the proportion of ¼ acid to ¾ water. For this boiling an *acid pan* is used, or a porcelain evaporating dish. We prefer the latter. In purchasing *an evaporating dish* it is preferable to get one about the size necessary to boil off a full upper set, as also to select one where the *inside* of the dish is *glazed or enameled* and the outside not enameled. Dishes made in this way rarely crack on being heated, while if they are enameled *all over* they crack very readily. An excellent, and almost everlasting acid pan may be made as follows :

Cut a disk of card-board to a round form with an extension on one side of its circumference as shown in Fig. 36. This disk should be about 4½ inches in diameter, exclusive of the extension, which should be an inch long. Lay the pattern of card-board on a piece of sheet lead ⅛ of an inch thickness, and cut it out to the shape of the pattern. This being done the sheet lead is gradually chamfered with a course rubber file from its centre to its circumference, as shown by the sectional delineation A, of Fig. 36. The disk may now be held on a "Croquet Ball," and with a horn hammer, striking it always at the thickest points,

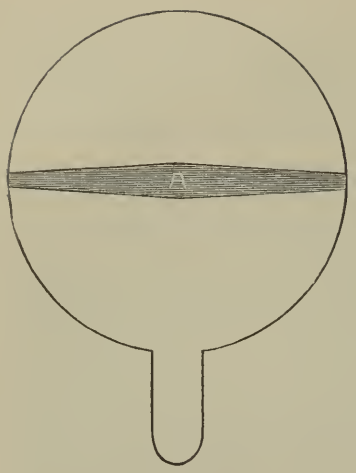


FIG. 36.

the soft metal may be stretched to a uniform thickness, into a hemisphere. The extension is intended for a handle. This may be punched with two holes, and a longer, stiffer handle of wood or metal rivetted to it. Such an acid pan will never crack and will last a life-time, as acid has but little effect on lead. The borax, used as a flux while soldering, is dissolved off by the action of the acid. It has been recommended after boiling the case in acid to boil in *solution of soda*, but this is not essential.

The case being soldered, the next step is to finish it. The safest way to do this is to invest in plaster, and when this is hard to remove all superfluous solder with *scrapers*, *gravers*, *solder burs* and small fine cut engine *corundum wheels and points* revolved in the polishing lathe. A perfectly uniform surface being thus secured, all the scratches left by those tools must be made smooth by means of pieces of *Scotch stones*, small *leather wheels* charged with *Tripoli* or *fine pumice stone*, moistened with water, or with small soft *brush wheels* revolved on the polishing lathe. The case is now scrubbed thoroughly with a brush, hot water and soap, and the plaster investment may be removed. The final polish is given with fine *rouge* or whiting, preferably moistened with alcohol rather than with water, by means of soft brush wheels or cotton buff wheels. The case is again scrubbed with a soft brush, hot water and soap, and is then ready for the mouth of the patient.

GRINDING THE TEETH.

Little can be said to indicate how this is done. To one with a mechanical turn, the fitting of a tooth in its proper place and position will be appreciated by the workman almost without instruction. There have been devices offered to hold teeth while grinding them, but to the workman they are of little use. The tooth, be it ever so small, can be held in the fingers against the corundum stone, in the grinding and polishing lathe, and the point needing grinding removed.

When the bite has been taken, and the plate (or plates) secured in the articulator, the plate is warmed and a rim of wax attached to it. The opposing model is brought against this rim of wax, and all that is displaced by it is dressed away with the warmed wax spatula. The teeth are now placed in position. In a full upper case with single gum teeth, the central incisors are generally taken first. These are pressed into the wax lightly in their proper position, one at a time, and fitted to the plate

by grinding it away little by little from the point that touches, until it is made to fit against the plate at all points. The gum surfaces of the teeth are next ground away. The next central is now fitted to the plate in the same way and then the gum surface is ground or jointed to its fellow. The lateral incisors are next fitted in the same way on either side of the centrals, in the same way as described for the centrals, and so on to the end. As each tooth is ground and fitted, it is our custom to wipe the wax dry in the place it is to occupy; the tooth is then warmed in the blaze of the spirit lamp, and a small quantity of adhesive wax is melted on it. While it is still warm it is put in its place, where it adheres firmly to the wax rim used to hold the teeth temporarily in place while grinding. Each tooth is stuck on the wax rim thus, after it has been ground and fitted. If this be not done the teeth will fall away from the wax rim, which gets wet from the frequent trying of the tooth, which gives considerable trouble.

It sometimes happens that there is a knob or knuckle on the plate, which requires very careful grinding to fit the tooth over it. It is very evident, that if *a large wheel* is used to grind a tooth over such a point, no fit can be made. To overcome this difficulty we make use of such small wheels as are used in the handpiece of the dental engine for operations on the teeth, securing them to a chuck, as shown at Fig. 37, and cutting a depression in the tooth to fit over the knob or knuckle on the plate.

Fig. 37.

The tooth being fitted, approximated, and articulated, a plaster matrix is made (as has already been described), to hold them in position while they are being backed or lined.

CHAPTER V.

We have proceeded to describe the various manipulations of plate work, up to the soldering of the case. It remains now to tell how the plate is finished preparatory to its insertion in the mouth.

The work having been removed from the acid, where it was boiled in order to dissolve off the borax, which was used as a flux for the solder,

and which by the action of the heat has become as hard as glass; is then well washed with soap and water.

If the plate is thin, or only a narrow strip—as is sometimes the case for a partial denture supporting only a few teeth, attached by clasps—and is likely to bend in the process of finishing; in such cases it is best to invest it in Plaster, while finishing.

The solder is then cut down with solder burs or small corundum points in a chuck, [shown by Fig. 37, page 37] which is set in the polishing lathe.

If corundum points are used, which are preferable, they should be kept wet while in use to cut down the solder, and the dripping will fall into the drip pan. A piece of paper should be laid over the entire bottom of the drip pan, and when the cutting down of the solder is completed, the water may be carefully poured off, and the gold saved which adheres to the paper. The paper may be dried, and the gold filings brushed off into any suitable receptacle; or the paper may be kept, and when a large quantity has accumulated, it may be burned and placed in a crucible, in which the gold may be melted into a button or nugget.

The corundum points used for cutting down the solder should be *of fine grit.* Those of course grit, while they may answer for very rough places, are apt to scratch the plate too deeply, and thus give extra trouble in making these places smooth for final polishing.

All the rough places being cut down to a uniform surface, these places are gone over again with small leather wheels, felt wheels, wheel brushes, etc., charged with tripoli, or fine pumice mixed *with water.* The wheel brushes should be small, as these reach places where large ones will not, and the bristles should be soft, as they carry the cutting powders better than wheels with stiff bristles.

The final polish is imparted with small brush wheels, with soft bristles, or with cotton buff wheels, charged with rouge. The wheels for this work should be kept away from dust and grit, and used for no other purpose.

If used promiscuously—as for polishing rubber plates, as well as gold or silver work, the fine polish, so desirable to be imparted to gold or silver plates, will not be secured, as gritty powders will find their way into the bristles, and leave ugly scratches on the plate.

The case, if it had been invested, is now freed by cutting off the plaster, after which it is well scrubbed in hot water, with soap and a fine brush, when it is ready for the mouth.

For polishing the inside of clasps a good plan is to tie to the sides of the work bench a hank of gilling twine or thread, about the size of the small finger. This is charged with fine pumice, or tripoli mixed with water. The end of the hank is taken with the left hand and the hank placed within the clasp. An up and down or sawing motion is given to the work which is held in the right hand, until the inside of the clasp is made smooth and polished by this manipulation.

A RIM FOR PLATES.

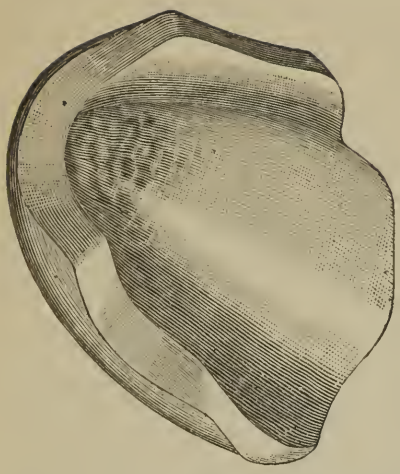


FIG. 38.

In continuous gum work, or in gold or silver plates with attachments for rubber or celluloid, it is advisable (especially for continuous gum work) to turn the plate on the outside to form this rim. This has generally been done, *by marking the plate line on the model*, building wax up to this line on the model, and after varnishing same, making a die with this manipulation of the model. The plate can thus be swedged with the rim. This manipulation of the model entails some trouble, and we are indebted to Dr. M. L Long for the following suggestion, which simplifies the operation. He removes the plaster impression from the impression cup, and marks the plate line *in the impression*. The impression is then cut down to a square edge, as shown in Fig. 38. A model is made, in the impression thus prepared, with much less trouble than by the plan of manipulating with wax. The model thus made is shown in Fig. 39.

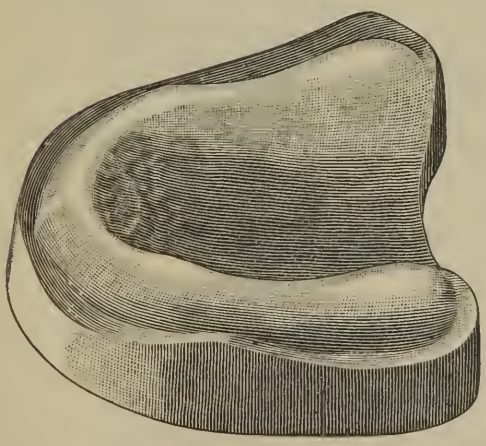


FIG. 39.

Such a rim does well, should the plate line have been *well calculated;* but if not, and there be a necessity for subsequent cutting, to relieve pressure or chaffing on the outside, the rim would be spoiled, at the point cut, and the beauty of the work marred.

REPAIRING GOLD OR SILVER WORK.

Any kind of artificial work which has been worn in the mouth for any length of time, gets coated with a mucus deposit, which is of a greasy nature, and which adheres to the denture quite firmly. It becomes necessary, before any attempt is made to repair a crack in the plate, a broken clasp, or a lost tooth, that the plate should be cleaned thoroughly of this greasy film. To do this effectually, the plate should be boiled in a strong

solution of soda, or concentrated lye, or caustic potash, *in a porcelain evaporating dish.* This being done, it is then boiled in the usual solution of sulphuric acid and water that is employed to dissolve the borax used in soldering. With this preliminary, which is important, the case may be proceeded with for the repair of the damage. Wherever the plate is to be soldered it should be scraped *perfectly clean and bright*, and, as a rule, considerable borax used, at the place of repair, with the solder. Silver work, as a rule, requires more borax than gold work. If a clasp is to be attached to a tooth in repair work, it may be necessary to take an impression of the tooth to be clasped. We have found a very convenient way to take an impression for such cases is to take a piece of pure tin-plate of No. 20 thickness of the gauge plate, about one inch wide by one and a half inches long. This is perforated with a number of holes, with a drill in the lathe, about one-eighth of an inch in diameter, or preferably with a shoe punch. The softness of the metal permits it to be bent into any form. The holes punched through it are for the purpose of holding the Plaster of Paris, of which the impression is taken, and preventing it from leaving the impression device. Such a device will also be found very serviceable in taking impressions for crowns or pivot teeth. Small impression cups, as shown in Fig. 40, have lately been designed by manufacturers, which serve well for this purpose. The plate being placed in position, impression plaster is mixed with water and an impression taken of the tooth to which the clasp is to be fitted, as well as the plate to which it is to be attached. A model is made from this, to which the clasp is bent and adjusted to the tooth and plate.

FIG. 40.

To attach a tooth to the plate it *may* be necessary, in repair work, to take the bite; but this will only be necessary when there is an abnormal closure of the teeth, or where an opposing tooth impinges into the space where the tooth is to be attached.

For repairing a crack in the plate, the crack should be well scraped and cleaned. Reliance should not be placed *only on the solder that flows into and on either side of the crack;* but a thin piece of pure gold or platinum should be burnished to fit closely over the crack and the solder made to flow into the crack, and under and over this piece of plate, to give strength to the fracture without unnecessary bulk.

REGULATING APPLIANCES.

The system of regulating the teeth by means of screws, bands, tubes, plates and springs require neat and small appliances for the accomplishment of the object in view. The strap band of Dr. Farrar will be found

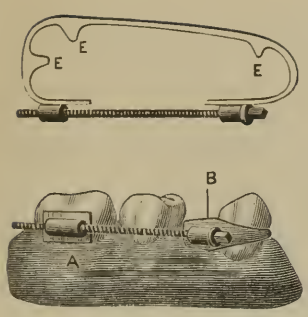


FIG. 41.

very efficient in quite a number of cases, either singly or combined with a vulcanite plate to form a solid immovable buttress by which other teeth are moved. Fig. 41 represents the strap band used to draw a cuspid back into the space recently occupied by the first bicuspid which has been extracted. To make a strap band, a piece of gold or silver wire is taken, in size large enough to pass through hole No. 1 of the bur gauge, and long enough to pass around the molar coming forward and passing around the cuspid. This wire is then annealed and held on the bench anvil, Fig 42, when it is hammered flat. Some small pieces of gold or silver scraps are collected and laid on a piece of charcoal, where they are fused into a globule and then thrown into the acid pickle.

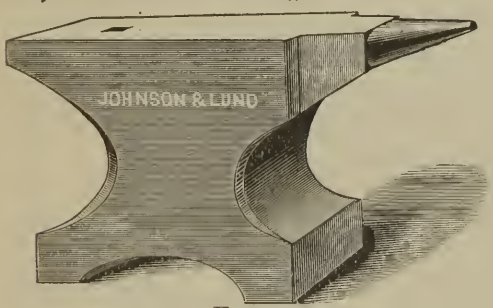


FIG. 42.

Removed from this, it is hammered flat until it is about one-thirty-second of an inch thick. Two of these globules are made; one for the *threaded* and the other for the *free* nut. To make the threaded nut, a hole is drilled through the piece of metal. *The drill* used for this purpose should be smaller than *the tap*. For instance: If the tap just passes through hole No. 6 of the bur gauge, the drill should just pass through hole No. 4 of the same. The hole being drilled for the threaded nut, the tap is secured into a pair of pin vises and a thread cut through the hole with the tap. The tap should be used carefully, with plenty of oil. The metal is held in another pair of pin vises and the tap gradually insinuated through the hole, coaxing it, as it were, until the thread is fairly cut. For the free nut it will only be necessary to drill a hole through the metal large enough to let the screw part of the bolt pass through snugly. The piece of metal into which the screw thread was cut is now filed down to its smallest dimensions, consistent with strength, and this soldered on to that end of the flattened wire that passes around the molar, on its buccal surface A, Fig. 41. To solder this we make use of small iron wire clamps, as shown in Fig. 43.

[FIG. 43.]

These little clamps are easily made of piano wire or iron wire, and will be found very serviceable for many purposes. One end of the clamp is passed into the hole of the threaded nut, while the other end is sprung over the end of the flattened wire that passes around the molar. This

holds the two in position while the solder is applied and melted so as to unite the two. In the cut (Fig. 41) these free and threaded nuts are shown as made of tubing; but to cut a thread in tubing will be found much more difficult than in a piece of solid metal; and it is for this reason that we have described a manner of doing this in the easiest way. The free nut is soldered to the other end of the flattened wire in the same way as described for the threaded nut. The two nuts being soldered on, the next procedure is to make the bolt which passes through the free nut and is caught into the threaded nut. For this purpose a *screw plate* will be needed. Fig. 44. Those made

[Fig. 44.]

by P. S. Stubbs, and known as "Stubbs' notched screw plates," are the best. To cut a thread on a piece of wire it is necessary that the wire should be *just the right size*. *If too small*, an imperfect thread will be cut on it; *if too large*, there is risk of breaking off the wire in the screw plate, out of which it is almost impossible to remove it. The best way we have found to determine the size of the wire, is to place a piece of brass wire in the chuck of the lathe and filing this down gradually (trying it from time to time and cutting a short screw on it) until the right size is ascertained.

When this has been ascertained, the wire is passed through the holes of the bur gauge and the size *noted* to cut a screw of a certain size. A note of this is made so as to save the trouble of the same procedure at another time. The wire of which the bolt is to be made, whether it is to be of gold or silver, is now placed in the chuck of the lathe and reduced by filing to the proper size by passing the hole of the bur gauge over it until it is of the right size. The threads are now cut on it, by holding it in the pin vise, Fig. 45, (or in the chuck removed from the lathe), and turning it round and round carefully in the proper hole of the screw plate. The bolt is made rather longer than is actually needed, any excess of length being easily cut off. After the threads are cut, a piece of plate is punched and a circle scratched on it with a *pair of dividers*, Fig. 46. It is then reamed out so as to fit over the screw and form a flange or shoulder at the head of the bolt. This is then passed over the threads, and is soldered to the wire of which the bolt is made. This being soldered, the edges are rounded with a file down to the mark scratched on it with the dividers, and the wire is placed in the chuck, on the lathe, and this flange is nicely filed, or turned, round. Fig. 47 represents the piece of wire on which the thread has been cut, as also the small piece of plate, B, which is to form the flange of the bolt head. This being turned round, as described, it is removed from the chuck and

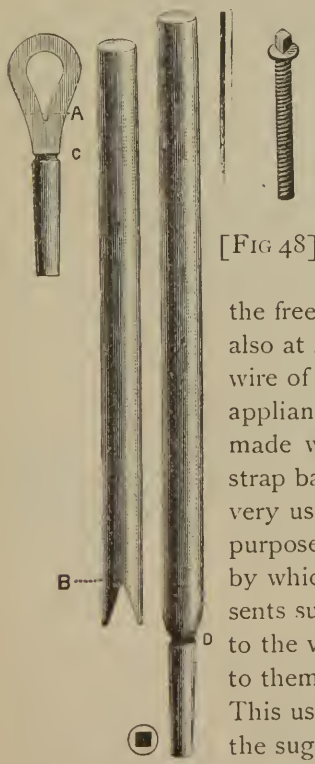
[Fig. 45.]

[Fig. 46.]

screwed into the screw plate down to this flange. Enough of the wire beyond the flange is now sawed off, to form the square head of the bolt, as shown at A, Fig. 47, and this is filed square, with a flat file, to fit the key to be used with it. Fig. 48 represents the bolt completed.

[Fig. 47.]

To make a key to be used by the patient will next be described. Watch keys, such as are shown at Fig. 49, may be bought at watch furnishing establishments at from 20 to 30 cents per dozen. One of these is taken and a part of the handle is filed off at the dotted line, A. A piece of iron wire about three inches long and the size shown at Fig. 49, is notched on one end, as indicated at B. This is dipped in soldering fluid (the muriate of zinc), and while held in the blaze of the spirit lamp it is tinned with tinner's solder at the slotted end. The key is likewise tinned in the same way from the points A to C. This part of the key is now inserted into the slot made in the iron wire at B, the two parts are held together with binding wire, and small pieces of tinner's solder are added to the two, and being held in the blaze of the spirit lamp until the solder melts, the two are united, as shown at D, Fig 49.



[Fig. 49.]

[Fig 48]

To complete the strap band, it will be necessary to solder two or three thin pieces of plate to the flattened wire, as shown at E, Fig. 41. These are intended to bend over the masticating surfaces of the teeth, to prevent the appliance from sinking into and wounding or irritating the gum. It is well to thicken or strengthen the strap band at the point that passes in front of the cuspid tooth, to which the free nut is soldered, as shown at B, Fig. 41, as also at A under the threaded nut, for as the flattened wire of which it is made is so delicate and thin, the appliance is apt to turn or twist when pressure is made with the key to tighten the band. A pair of strap bands, such as has been described, will be found very useful if attached to a vulcanite plate, for the purpose of forming a firm, steady, immovable fixture, by which other teeth may be moved. Fig. 50 represents such an appliance. The strap bands are attached to the vulcanite plate by means of extensions soldered to them, as indicated by the dotted lines in Fig. 50. This useful contribution to regulating appliances is the suggestion of Dr. Farrar.

While we have described the manner of making

bolts for these straps, as also the manner of making keys to be used with them by the patient, we must admit that the process is attended with considerable labor and tediousness, and we have adopted a plan lately by which much of this labor can be overcome. Dr. How has instituted a system of screw posts and nuts for pivoting teeth, and some of the screws which he uses for pivoting teeth may be made very available for making the bolts for strap bands. By this system the making of bolts and threaded nuts (so troublesome and tedious) can be entirely dispensed with, and the work which would consume almost a day to accomplish may be done in two or *three hours at farthest.* By reference to Fig. 51 it will be seen that these screw posts are made in three sizes, either of which is quite large enough and strong enough to make traction on the tooth to be moved. It will be seen that the post B, Fig. 51, has a threaded nut on it. (The other sizes, A and C, may also be procured with threaded nuts to fit.) This nut may be soldered to the strap band at A (Fig. 41), while a free nut, which is easily and quickly made of tubing, or of a solid piece, as before described, can be soldered at B (Fig. 41), and the appliance completed in a short time. To make the square-headed bolt, as shown at Fig. 48, the headed screws (Fig. 52) may be used with the nut as shown at Fig. 51. A flange may be soldered below the head, as described and shown at Fig. 47, after which the head of the screw may be filed square to fit the key shown at Fig. 49. Should it be desirable to have a longer bolt than the "headed screws," the little nut as shown at B, Fig. 51, may be carried to the end of a long post and soldered to it. A flange, as shown at Fig. 47, may be also soldered to this post beneath the nut, and the nut filed square to be used with the key, Fig. 49. If Dr. How could devise these headed screws *with a solid head* they would be of great advantage to the dentists in making regulating appliances, and doubtless for other purposes.

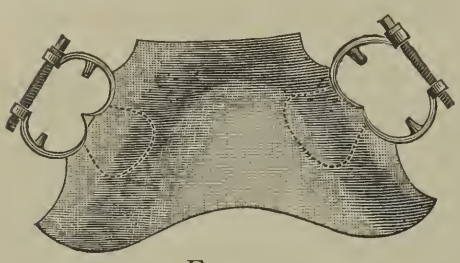
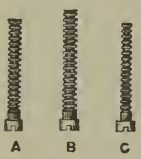


FIG. 50.

[FIG. 51.]



[FIG. 52]

TO MAKE TUBING.

Take a piece of metal, gold, silver or brass, about No. 30 thickness of the plate gauge. Let this be about three or four inches long and about a quarter of an inch wide. Cut the edges perfectly straight and parallel to each other. Anneal it, and commence to bend it along its entire length with a pair of *plate benders.* After it is thus started, lay a large

steel knitting needle in this gutter-like piece of plate, and complete the bending of the plate into a rough tube, over the knitting needle, with flat nose pliers. This being done, take a piece of wire (gold, silver or brass, according to the tubing you are making), and secure it in the chuck of the lathe. File or turn on one end of this wire a shoulder, so that the part filed will fit snugly in the rough tube you have made, as described above. This being done, the wire is removed from the chuck and the other end sharpened so it will pass through the holes of the wire plate. Fig. 53 shows the piece of wire subjected to the above process. The part filed to a shoulder, A, is now soldered *into* the rough tube, and after filing off the excess of solder it is passed through the holes of the wire plate and thus reduced to the size desired. The object of this wire is merely to have something solid to hold to while passing the tube through the holes of the wire plate. Silver or gold tubing thus made will be found very serviceable for many appliances used for regulating the teeth.

[Fig. 53.]

To make a split plate, it will only be necessary to mould a piece of wax over the palatine surface of the model. This is flasked, vulcanized and finished; after which two holes are made in the plate for the reception of the ends of the piano wire springs, when this is again vulcanized. It may be done with one vuclanizing, but if so done, it will be impossible to polish the plate, as the piano wire spring will be in the way, so that for the comfort of the wearer this little extra trouble may be taken. To vulcanize the springs into the plate it will be necessary to coat the ends which enter the rubber with tin. If this is not done the rubber will not harden around the spring on account of the affinity which the sulphur in the rubber has for the iron. To do this, the ends of the springs are dipped in soldering fluid (the muriate of zinc), after which they are dipped into melted tin or tinner's solder. To do this nicely a neat little pot or receptacle can be made out of a brass thimble to which a suitable handle is *hard soldered* or riveted, as shown in Fig. 54. Pieces of tin or tinner's solder are placed in the pot, where they are readily melted over the blaze of the spirit lamp, and, while melted, as much of the spring is covered with tin as is deemed neccessary by dipping the ends in the melted tin.

Fig. 54.

To twist a tooth, nothing is so effective as a platinum band burnished

to a tooth *in the mouth* (or on a tooth of the plaster model) with pieces of tubing soldered to this band at points most suitable for the rotation. For this purpose very thin platinum plate is passed around the tooth (in the mouth or on the model) and fitted nicely to it by burnishing. This is removed carefully and the lapping ends soldered with gold solder. The tube is now soldered to the band and the band secured to the tooth with phosphate of zinc. Fig. 55 illustrates the idea which has been suggested by Dr. E. H. Angle, of Minneapolis. The same principle may be applied to rotate a tooth as well as to press a tooth inward by the united efforts of a band of this kind to which rubber rings are attached and fastened to Farrar's strap band plate, as shown at Fig. 50.

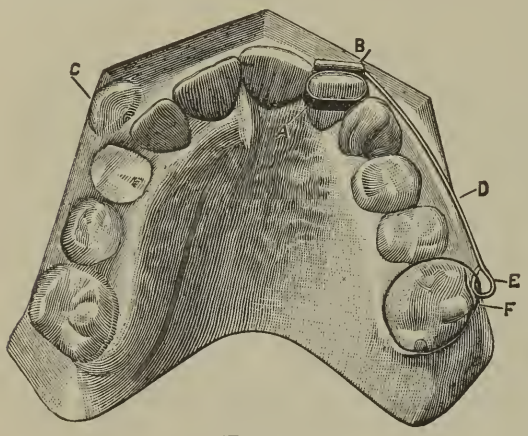


Fig. 55.

To make the Kingley's stay plate, I have found the following plan most available as well as simple. The teeth being gotten straight, a piece of thin platinum plate of the necessary length (from cuspid to cuspid) and about one-eighth of an inch wide is closely fitted to the outer faces of the teeth by burnishing. Another piece of the same, a trifle narrower, is burnished to fit closely against the first, and these two pieces are soldered together. A third piece, still narrower, may be burnished to the others and likewise soldered, and to these a piece of gold or silver wire may be hammered flat and fitted to these pieces of platinum, and passing between the cuspid and bicuspid is bent to fit against the palatine surface of the model. This wire band is then soldered to the prepared platinum, Fig 56, after which it is filed, finished and polished, and finally vulcanized into a plate of vulcanite covering the roof of the mouth. It need scarcely be mentioned that should silver wire be used, instead of gold, the ends that pass inward to be vulcanized into the

Fig. 56.

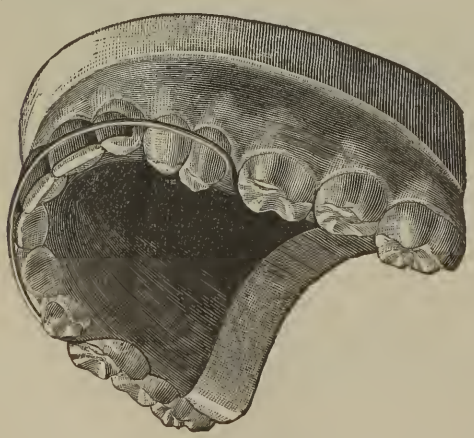


Fig 57.

plate, must be well coated with tin or tinner's solder before vulcanizing, as described in this paragraph where "piano wire" springs are used. Fig. 57 illustrates the Kingsley's stay plate.

The cut Fig. 56 is represented very much smaller than it should be. It should be as large as it is shown in Fig. 57.

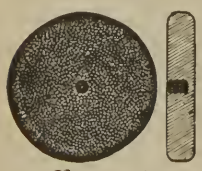
CHAPTER VI.

CROWNS.

We propose now to take up the subject of "Crowns," and to describe the process of making these from the simplest forms to those of a more complex nature.

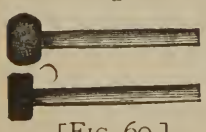
[FIG. 58]

For the crown which we will now describe, we proceed as follows: As a typical case, we will take *a central incisor.* The natural crown is nearly all destroyed by decay and the nerve dead. With a spoon excavator like Fig. 58, we remove all the loose decay until we reach the sound dentine. The work may be hastened by applying the dam over *the four front teeth*, especially if there is sufficient of the tooth left that we are to crown, to pass a ligature around so as to retain the dam in place. Once this is applied and the ligature tied *well up on the neck of the tooth* (or its remains), the treating of the root (if it need treatment), the sealing of the apical foramen, the enlarging of the nerve canal, and all the work connected with the operation may be carried on much more tidily and with much greater dispatch than if done without the dam: besides, by tying the dam well up on the neck, the gum seems to be pressed away to such an extent that often nearly the whole operation can be performed with the dam in place.



[FIG. 59.]

The apical foramen is sealed, and the hole for the pivot or dowel *partially made;* the remains of crown is dressed down with a stump corundum wheel like Fig. 59, or with a corundum point like Fig. 60, these being kept wet (over the dam) with water dropped on with a pipet, or with a small piece of wet sponge. The root being cut down, we proceed to complete the hole for the dowel.



[FIG. 60.]

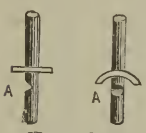
This may be done with fissure burs of graduated sizes, like Fig. 61, these instruments being used in the hand-piece of the dental engine, and the increase in size being accomplished by using successively from a smaller to a larger tool; and the size being determined

according to the root that is being worked on. The depth of the hole for the dowel need not be greater than the cut surface of these instruments; from a quarter to five-sixteenths of an inch deep. The hole being made, a piece of gold, or platinum and iridium wire is fitted into it. This should fit snugly, but not tight. A good plan is to let about as much space as would be occupied by a thickness of writing paper between the outer surface of the dowel and the walls of the dowel hole.

[Fig. 61.]

We proceed next to make the face plate. We make this ordinarily of a piece of very thin platinum plate. We cut this oval, sufficiently large to cover the face of the root, and we pierce it with the point of any sharp instrument. Fig. 62 is the face plate. Holding this for an instant in the blaze of the spirit lamp to warm it, we drop on it a small quantity of adhesive wax. We then warm the dowel and pass this, a little more than the eighth of an inch, through the hole *in* the face plate. The two pieces are then carried to the mouth of the patient and put on and into the prepared root. About a quarter of an inch of the dowel is cut off below the face plate. It is then removed from the root. The part of the dowel which is to be *in* the root is seized with a pair of flat nose pliers, and the protruding end of the dowel is well nicked with a file on one side (say towards the front), A, Fig. 63. The whole face of the face plate, where the dowel protrudes (A) is now covered with more adhesive wax, and before this chills thoroughly it is placed in and over the root, and the dowel pushed into the root as far as it will go. While it is held with the fingers of the left hand by the protruding end, with burnishers, like Fig. 64, in the right hand, the adhesive wax on the face plate is pressed upon, until a perfect fit of the face plate to the root is obtained. The reason we cover the face plate with adhesive wax is because this substance, before it gets hard, is perfectly dead, inelastic and without the least spring, so that when it is manipulated, as we have described, a perfect fit is obtainable. The dowel and face plate may now be removed from the root. A small bit of wax is placed on the glass slab in the laboratory, and the protruding part (A) placed into this piece of wax so that it will stand in the position on the slab, as shown in Fig. 63. It is now invested in plaster and sea sand, and while the investment is hardening a tooth may be selected, ground and fitted to the root, which can be very nicely done with the dam still in position. The tooth may be backed and gotten ready for the dowel and face plate.


Fig. 62.



[Fig. 63.]


Fig. 64.

The investment being now hard, the dowel is soldered to the face plate, after which it is boiled in acid to dissolve off the borax. The dowel and

face plate may be tried again on the root, and any little inaccuracies of fit corrected by pressing the face plate against the root with a burnisher.

Should it happen that the operation cannot be carried on to its completion, the dam may be removed from the teeth, the dowel and face plate put in position and a plaster impression taken of the parts. The little impression cups, Fig. 65, being admirably suited for impressions of such cases. At least one tooth on each side of the root that is to be crowned should be included in the impression. The nick which was cut on the protruding end of the dowel was made so that the plaster would enter it, and in removing the impression from the mouth the dowel and face plate would be brought away also. The impression is now painted with shellac varnish, and when this dries fine powdered soapstone or French chalk is rubbed with a small camel's-hair pencil all over the impression, and all the surplus dusted away. A pin, with the head cut off, is stuck into the depression of each tooth of the impression, and a model is made. When the model is hard it is removed from the impression. The use of the powdered soapstone is for the purpose of producing a smooth surface to the model, as well as to aid in removing the impression from the model. The protruding end of the dowel is now seized with a pair of flat nose pliers, and with a slight twisting motion it is removed, with the face plate, from the model. The protruding end is now cut off, with the cutting nippers, close to the face plate, when the porcelain tooth may be ground, fitted and aligned in its proper position on the model. The tooth is then backed, and afterwards stuck to the face plate with adhesive wax. The adhesive wax is then chilled, when the tooth is removed from the model. It frequently happens that it is considerable trouble to remove the tooth, with the face plate and dowel, from the model, without the risk of moving the tooth from its position or alignment, or without considerably marring the model by insinuating an instrument beneath the face plate in order to pry it out. We are indebted to Dr. W. H. Trueman for the following suggestion, by which both of these may be overcome. After the tooth has been gummed to the face plate with adhesive wax, the little model is turned over and a conical hole cut into the base until the dowel is reached. A blunt pointed instrument is now pressed on the dowel, which pushes this and the tooth out, without danger of disturbing the position of the tooth or of mutilating the model. Fig. 66 explains better what we have attempted to describe. In the engraving the front part of the model has been cut away to show the conical hole, which was cut in the base of the model in order to reach the end of the dowel. The end of the dowel is also shown.

Fig. 65.

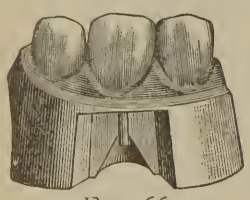


Fig. 66.

We desire to suggest a slight advantage to this plan. Often in cutting the conical hole at the bottom of the model, in order to reach the end of the dowel, considerable trouble is experienced before the end can be reached, as it is difficult to locate it exactly. When the plaster impression is removed from the mouth, with its adherent face plate and dowel, place on the end of the dowel a minute film of adhesive wax. Now take a piece of iron wire about ½ inch long, file it flat on the end, and, heating it slightly, put a film of adhesive wax on this. Apply this piece of iron wire to the end of the dowel in the impression so as to make, as it were, an elongation of the dowel; *then fill the impression.* This is shown in Fig. 67. When the model is made the piece of iron wire serves as a guide to direct you in your cutting, in order to reach the end of the dowel.

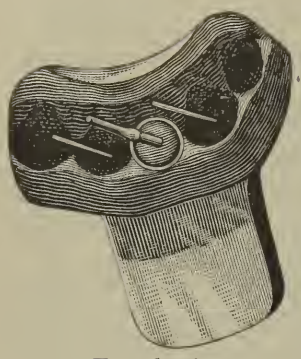


Fig. 67 A.

The tooth is then invested and afterward soldered, and then finished and polished ready for insertion. After the tooth is soldered, it will be found that the gold solder is *very hard to file up*, so that lately we have been using corundum wheels to do this finishing. It can be done much more expeditiously with corundum wheels on the lathe than with files, and much more economically, as corundum wheels are cheaper than files. The gold cut away with the corundum wheels need not be lost. A piece of paper may be placed over the bottom of the drip pan, and all the gold cut away in finishing falls, with the water, on to it, after which the paper may be lifted out and dried and the gold thus saved.

If the case can be proceeded with without resorting to the trouble of taking an impression and making a model, as we have described, the dam (in many cases) need not be removed.

Indeed, we may offer a suggestion by which a tooth may be entirely crowned (in many cases) and the root freely cut below (or above) the gum margin and yet have the great advantage of keeping the dam in position during the entire operation. When the case first presents, wrap a piece of gilling twine or ligature silk around the root several times (from 3 to 5 times), pushing each lap well up on the neck of the remains of the tooth, until the gum is whitened, when it may be securely tied and the patient dismissed for a day. At the next appointment, on removing the ligature, the gum will be found absorbed or well pushed away from the neck of the tooth, so that the dam may be applied and the parts easily operated on, without blood and with perfect dryness, which is of the greatest advantage in this kind of work. In cases where the whole crown of the tooth is consumed by decay, this, of course, cannot be done, but a very fair view of the root may be obtained as follows: Clean away

as much of the decay from the face of the root as possible, and partially ream out the nerve canal. Wipe dry, and place in the canal a little spicula of red gutta-percha; build around the head of a gimp tack a pellet of red gutta-percha about the size of a buckshot; heat this as well as the point of the tack and press it quickly into the root. Manipulate the gutta-percha with a large ball burnisher all over the face of the root, so as to force it all over the margins of the root. When the case presents for crowning, at the next appointment, the root will be in much better condition to work on than if this preliminary had not been taken.

The protruding end of the dowel, above the face plate, may be cut off close. The porcelain tooth being backed with gold, is fitted to the root, when it is stuck to the face plate with adhesive wax and properly aligned. The dam may now be removed, so that the lower tooth can be brought in antagonism to ascertain the proper articulation. The tooth may then be invested, soldered and finished, as has already been described. Although not connected with *laboratory work*, we will describe the insertion of such a tooth as we have been constructing. When the tooth is finished, the dowel is well scored, as shown at A, Fig. 68. It is then seized carefully with a pair of straight incisor forceps, as shown at B, Fig. 68, when it is passed to and fro through the blaze of a spirit lamp until the tooth and dowel are thoroughly heated. Some white gutta percha, which

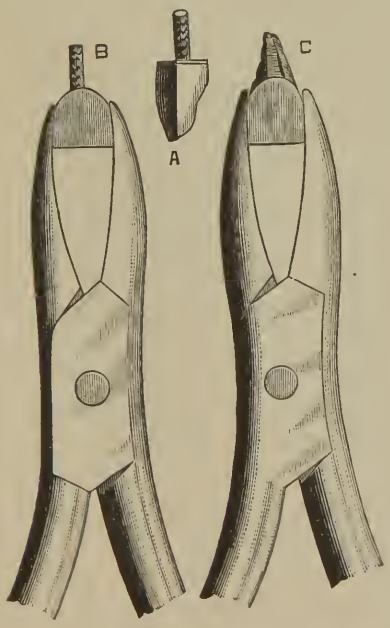


Fig. 68.

Fig. 70.

softens at a low heat, is now placed all over the dowel and face plate, to

which it adheres tenaciously, and built up into a cone, as shown at "C" Fig. 68. While the gutta-percha is still soft, the dowel is passed into the root and pressed into place, the surplus of gutta-percha oozing out over the front, back, and sides of the face plate. Before the gutta-percha gets perfectly hard, the crown is carefully removed and the surplus carefully cut off. With a wheel bur in the dental engine, a groove is cut within the dowel hole of the root, as shown at Fig. 69—A. The crown is again heated as before described, by passing through the blaze of the spirit lamp, and the *least bit* of gutta percha added to the dowel. The lips of the patient are protected with a napkin, and the hole in the root *thoroughly dried.* The instrument Fig. 70, (which is only a piece of brass, hard soldered to a shank of brass wire, and mounted into a wooden handle the size of the cut), is heated hot in the blaze of the spirit lamp, and while the tooth is kept warm and the gutta-percha soft, the dowel is entered into the root, when the forceps are laid aside and the instrument Fig. 70 is taken and placed over the porcelain tooth, when it is gradually and steadily carried to its proper position. The heat of the instrument serves to keep the gutta-percha soft, and this insinuates itself into the groove cut into the root shown at "A" Fig. 69. The hot instrument may now be removed, and the tooth held in its position until the gutta-percha hardens, when the operation is complete. For a crown constructed on this principle, not over two hours should be consumed. To insert "a ferrule" or Richmond crown, which we will describe, more time is necessary.

[Fig 69.]

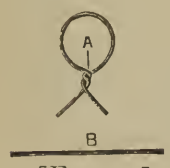
THE FERRULE CROWN.


[Fig. 71.]

Strictly speaking, the preparation of the root for the insertion of crowns does not come under the head of laboratory work; yet to give a description of this may be acceptable to our readers.

For fitting a ferrule around a root, the root must be stripped of the remains of enamel, which lies just under the free margin of the gum. To do this the root should be dressed down with the stump corundum wheel in the dental engine. A strong steel instrument, tempered very hard, and having its end or point bent at nearly right angles and sharpened to a point, like a scaler (which any dentist can make for himself), will do this part of the work. Fig. 71 shows the instrument. The instrument is used in the right hand. With the thumb resting firmly and steadily on some contagious tooth, the point is passed beneath the free margin of the gum, where it catches the enamel. A steady pull strips it from the root, or powders it, so that by continued use of the instrument in this way the enamel is removed, and such a bevel or parallel given to the end of the root as to enable the dentist to fit the ferrule accurately. The size of the root is taken by passing

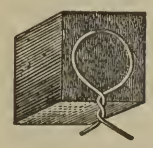
a piece of binding wire around it and twisting the free ends with a pair of flat nose pliers, until the wire hugs the end of the root closely. The wire is then removed, and it is cut at the twisted part A, Fig. 72. This is then straightened out as at B, Fig. 72, when it is laid on a piece of pure gold plate, 1-16 of an inch wide, and about 30 thick. It is cut about 1-16 of an inch longer than the twisted wire gauge as shown at B, Fig. 72. The two ends are chamfered to a feather edge, so that when the lap is made there will be no more bulk at the lapped ends than at any other part of the ferrule. The lapped ends are then soldered, the ends being retained next each other by means of a small iron wire clamp, shown at Fig. 43.



[Fig. 72.]

A very good plan has been suggested to make the ferrule of a Richmond crown—or an all gold crown, as follows:

When the wire has been twisted around the prepared root, as shown at Fig 72, A, and carefully removed, it is laid on a piece of straight, close grained wood, as shown at Fig. 73. With a well directed blow of a hammer this is driven into the wood, which leaves it imbeded. The wire is now removed, and the wood whittled and filed down to the mark left into it by the wire, which is the exact size and shape of the root. Around this pattern of the root the ferrule may be bent, which if carefully done will exactly fit the root.


[Fig. 73.]

As it is sometimes quite difficult to convey the heat just at the point where it is wanted—without overheating the metal at a part where heat is not wanted, thereby often causing the solder to daub the band, or refuse to flow at the point where union of the parts is necessary—a special device to meet such cases is needed, and will be here described, before proceeding further with the subject of the ferrule crown.

Take a piece of sheet-iron and cut it into the shape shown at Fig. 15. This should be about 4 inches square. The ends 1, 2, 3, 4 should be bent up so as to form it into a box, and a hole punched in the centre. A large headed tack or nail may be driven through the hole into a handle. Equal parts of Plaster of Paris, Powdered Kaolin Clay, and Powdered Asbestus are well mixed together by grinding in a mortar, when they are moistened with water to a doughy consistency and put into the box. While the mass is still soft, a round 8 ounce weight is pressed into it, so as to make a depression, and two pieces of iron wire being bent like that shown at Fig. 74 are pressed into the mass, when it is laid aside to dry and harden. We are indebted to Dr. Hall for the proper proportions, as well as for the ingredients for making this kind of soldering device. The soldering appliance thus described is shown at Fig. 75. With this


[Fig. 74.]

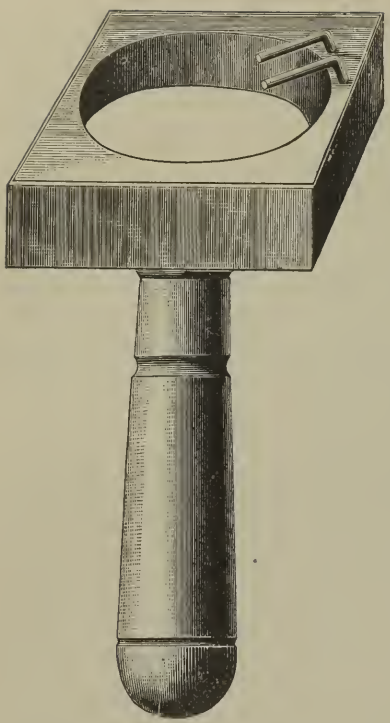
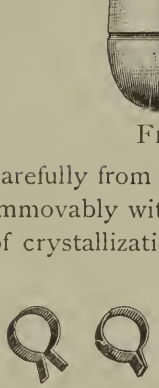


FIG. 75.

appliance, a ferrule, a metal crown, the cap or cover for a ferrule, and very many other small objects, used for crown work or regulating appliances, may be laid on the pieces of iron wire (which can be brought close together or separated wide apart), and there soldered, with the advantage of being able to apply the heat just where it is needed.

Another very easy and expeditious way of making a ferrule is as follows: —Take a piece of pure gold, No. 30 thick and 1-16 of an inch wide, and about an inch or an inch and a quarter long, bend this around the round handle of an excavator, as shown at A Fig 76. Place it around the root and squeeze the ends tight with a pair of flat nose pliers until it fits the root snugly at every part. Abandon the larger flat nose pliers and seize it again with a delicate pair, and remove it carefully from the root. Paint the junction of the two ends (still held immovably with the pliers) with borax, blow a blast on it until the water of crystallization has passed out of the borax, and then place a minute piece of gold solder (about the size of a pin's head) at the junction and fuse it. This will give you a ferrule, as shown at B, Fig. 76. In bending this, the two ends were seized at the *labial* surface of the root. The ferrule is now placed over the root again so that the ends will be at the *palatal* surface, which is readily done by a little manipulation with a burnisher. When it is made to fit in its new position it is carefully removed. The parts of the ferrule which pass on the root proximate to the adjoining teeth are now filed out or festooned so as to conform to the gum margin. This may be done either with a fine file or



[FIG. 76.]

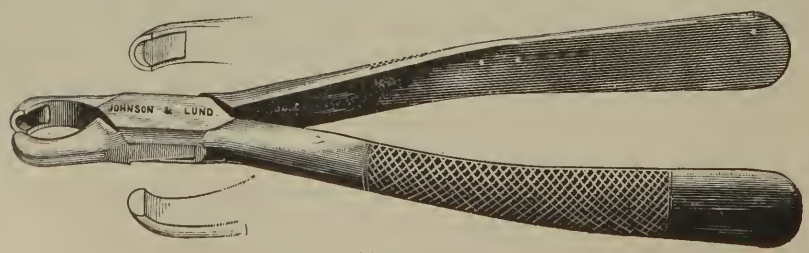


FIG. 77.

with the cutting nippers, Fig. 77, as shown at Fig. 78. The other part of the ferrule is filed like a gable roof. A piece of pure gold of similar thickness is bent like a gable roof, A, Fig. 78. This is painted on its concave side with powdered borax and water, finely ground to a creamy consistency, and the ferrule laid into it. The two are held together by *very fine binding wire*, Fig. 79, when it may be laid on the wires of the soldering appliance, Fig. 75, and united by solder. The overlapping edges of Fig. 79 serve as ledges on which to place the pieces of solder. When soldered these ledges are filed flush with the sides of the ferrules, and should the plan for making the ferrule, as shown at A and B, Fig. 76, be adopted, the protruding end is likewise filed off close to the ferrule. Before replacing this on the root, a hole is punched in the cap or gable for the accommodation of the dowel. This hole may be increased to the proper size for the dowel, either with five-sided taper broaches or it may be placed on the root (after the hole is punched) and the hole brought to the exact size with sugar-loaf shaped *fine cut* burs, Fig. 80, in the dental engine. The dowel is now fitted to the root and a little adhesive wax placed on the gable. The dowel is warmed and passed through the hole, when a little more adhesive wax is put on, and a protrud ng end of the dowel of about 3-16 of an inch left over the gable. It is then carried to the mouth while the wax is still pliable and all put in proper position. The wax is then thoroughly chilled, when it is carefully removed from the root, invested and soldered.

[Fig. 78.]


[Fig. 79.]


243. 245. 246.
[Fig. 80.]

If the work cannot be carried to completion, the protruding end of the dowel, above the gable, is deeply nicked with a file and an impression taken with the ferrule on the root. It may be well here to remark, that before filling the impression thus taken, the inner part of the ferrule should be carefully filled with wax *nearly* up to its edges, A. Fig. 67. If this precaution be not observed before filling the impression, the plaster will flow into the ferrule, and in attempting to remove it, when the impression is cut away from the model, all the plaster within the ferrule will be broken away, and there will not be that certainty as when the above recommendation is observed. The ferrule is now removed from the model and the protruding end of the dowel cut off, as shown at Fig. 81. A tooth is backed and ground to fit the gable or cap of the ferrule. It is united to it with adhesive wax, removed from the model, invested, soldered and finished, as shown at Fig. 82. The insertion of a ferrule crown is accomplished in the same way as indicated for the other, or it may be inserted by the use of phosphate of zinc cement instead of gutta-percha. The latter, however, is always to be preferred, for in the event of the porcelain


[Fig. 81.]


[Fig. 82]

face breaking, there will be considerable trouble in removing the dowel from the root if phosphate of zinc cement is used.

CHAPTER VII.

COLLAR CROWNS.

The Collar Crown. It sometimes happens that we find the roots of the central and lateral incisors and the cuspids, although considerably decayed in their labial aspects, with large portions of their palatal aspects still untouched by decay, and it behooves the dentist to save all such parts of the natural teeth, which experience teaches is best to preserve. If the enamel be examined on the different parts of the crowns of teeth it will be found that in the upper incisors and cuspids it is thicker on the *palatal aspects* than elsewhere. This would seem to indicate that more strength was needed at this point of the tooth. Next to the Ferrule Crown there has been no crown yet devised so strong as the Collar Crown. The bearing, or strain in biting, is brought almost entirely on the *palatal surfaces* of the upper front teeth in the normal close of the teeth, and it is in view of this fact that we should take advantage of every indication which points to the making of our work as strong and as serviceable as possible.

Fig 83 represents the remains of a central incisor crown and root; A being its *Palatal* and B its *Labial* aspect. We prepare such a root by dressing down its face, as shown at C, of the same cut. The foramen being closed and the canal being prepared for the dowel, we prepare for constructing the collar. This is done by taking a piece of pure gold No. 30 thick and of the size and form shown at A, Fig. 84. It is then bent around the round handle of an excavator, first with the fingers and then by seizing the ends with a pair of flat-nose pliers. Transferring it to the root, it is bent to fit this. The wider part of this band, *i. e.*, the part designed to cover or fit over the palatal part of the root and marked with a cross at "A," Fig. 84, is then contoured into shape with the contouring pliers, as shown at B, Fig. 84. The spreading ends (caused by the slight elasticity of the metal) are brought together, while it is on the root, by holding it firmly with a pair of flat-nose pliers, and the band accurately burnished to fit all parts of the root. It is then carefully removed from

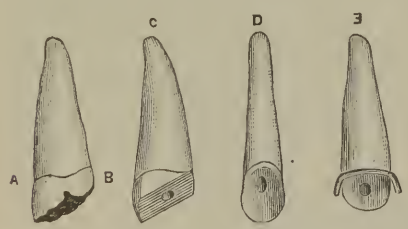


FIG. 83.

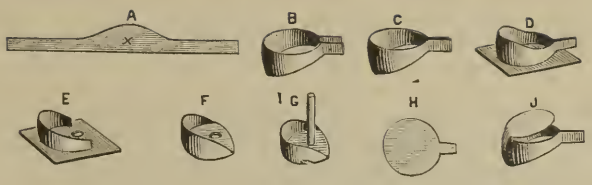


FIG. 84.

the root and the ends soldered together, as shown at C, Fig. 84. The top part of the band is now made perfectly flat, either with a fine file or by holding the band against the side of a fine corundum wheel, revolved and kept wet, in the lathe. A face plate is then soldered to it, as shown at D, Fig. 84, the band being ligated to the face plate before soldering, in the manner shown in Fig. 79. A hole is now punched with the plate punch through the face plate for the accommodation of the dowel, and the size of it increased, either with five-sided taper broaches or with fine-cut sugar-loaf burs, as shown in Fig. 80, and the protruding ends of the collar, which were seized with the flat-nose plyers when this was being fitted to the root, are filed down level with the face plate, as shown at E, Fig. 84. The collar should extend about three-quarters of the circumference of the root. The overhanging edges of the face plate are next cut off close to the collar (preferably with the cutting nippers, Fig. 77), and then filed neatly, *but not flush*, with the edges of the collar, as shown at F, Fig. 84. The dowel hole in the face plate should be *well countersunk on the under side*, and it is then held for an instant in the blaze of the spirit lamp to warm. A minute drop of adhesive wax is next applied to the *upper part* of the face plate, and this finds its way through the dowel hole and fills the countersink on the under surface. The dowel being fitted to the root, is then warmed and coated with a *film* of adhesive wax. The collar, with its face plate, is then placed on the root and the dowel pushed through, as far as it will go, into the root. It is then removed and more adhesive wax applied to the protruding end of the dowel and over the face plate. It is again placed on and into the root before the adhesive wax gets hard, and any little inaccuracies of fit rectified with the burnisher. It is now removed from the root, invested and soldered. The object of countersinking the dowel hole on the under side of the face plate, and of allowing the adhesive wax to fill this up is, that when the dowel is soldered to the face plate the solder will creep through and fill the countersink, thus holding the dowel securely to this surface, for, when the protruding end of the dowel is cut off, after soldering, it is often necessary to file this off *so flush* with the upper surface of the face plate that the dowel is very insecurely held, unless a provision of this kind be made. The collar with the face plate and dowel are shown at G, Fig. 84. A porcelain tooth (preferably one with cross-pins) is now selected for the case, ground, fitted and backed. It is then gummed to

the collar and face plate (G, Fig. 84), tired on the root, aligned, articulated, invested, finished, polished and inserted, as described for the other crowns.

Many cases occur where, although there may be considerable of the palatal aspect of the root left, nearly all of the face of the root, forward of this, is so scooped out that there is a concavity instead of a plain flat surface on the face of the root, as shown at D, Fig. 83. In such a case a flat face plate could not be soldered to the collar, because there would be a considerable space between the concavity on the face of the root and the under side of the face plate. If the attempt be made to make the face plate fit into this concavity by burnishing heavily, the edges of the collar on both proximate surfaces would be thrown outward towards each adjoining tooth, as shown at E, Fig. 83, and, therefore, the collar would not fit; and if it be attempted to rectify this faulty fit of the collar by bending the collar inward, the face plate would resume its first position. Under these circumstances, it will be better to burnish a piece of gold into the concavity with the collar still in position on the root, after it had been fitted and soldered, as shown at C, Fig. 84, or it may be still better done by fitting a piece within the collar and leaving a small extension, as shown at H, Fig. 84. This being done, the extension is tacked with a minute bit of solder to the back part of the collar, as shown at J, Fig. 84, and then the collar placed over the root. The face plate may now be accurately burnished to fit the concavity of the face of the root, when it is removed (preferably invested) and soldered. This being done, a hole for the dowel in this concave face plate is made, the dowel inserted and the rest of the work carried to completion as described in the other case.

THE METAL OR ALL-GOLD CROWN.

In the construction of this style of crown the end of the root is prepared in the same manner as described for the construction of the "Ferrule Crown." This being done, the size of the end of the root is taken, whether for a *molar* or a *bicuspid*, by twisting a piece of binding wire around it, as shown in the cut Fig. 72. It may be well to remark here that there is frequently a depression or flattening on the sides of the bicuspid roots, which, when the wire that is twisted around them, should be burnished or pressed into these depressions, so as to get the exact form of these roots, before the wire is taken off. When taken off, it should be laid on a piece of straight-grained wood and treated as described for the ferrule crown, as shown at Fig. 73. These directions apply alike for a bicuspid or for a molar crown. A piece of pure gold about 3-16 of an inch wide and about 1-16 of an inch longer than the wire measure of the root should be chamfered to a feather edge on both ends, lapped and soldered, as described for the ferrule crown. It is then fitted to the wooden model

of the root, which has been whittled and filed into the shape indicated upon it by the wire pattern, which was driven into it. This being done, it is tried on the root to ascertain the fit. It may be well to make the wooden model the *merest trifle smaller* than the root, so that if the ferrule should not pass over the root snugly it can be stretched by a few light blows of the rivetting hammer on the horn of the bench anvil. The ferrule being fitted to the end of the root, as shown at A, Fig 85, it is then contoured with the contouring pliers. This contouring, however, will not be enough; for though the metal may have been stretched and puffed where the contouring pliers pressed it, it will be found that the part of the ferrule which hugs the root and the part to which the cap is to be soldered are both of the same size. After this first contouring is accomplished, the upper part of the ferrule (not the part which encircles the root) is held delicately on the end of the round horn of the bench anvil by the fingers of the left hand, while with deftly delivered blows of a light rivetting hammer in the right hand, this part of the ferrule is stretched until it is the same size as the part which was contoured. The ferrule is now carefully annealed, and the contouring pliers again used, and the same manipulation of the anvil again gone over until a sufficient stretching of the band or ferrule is attained at its upper or masticating border,

Fig. 85.

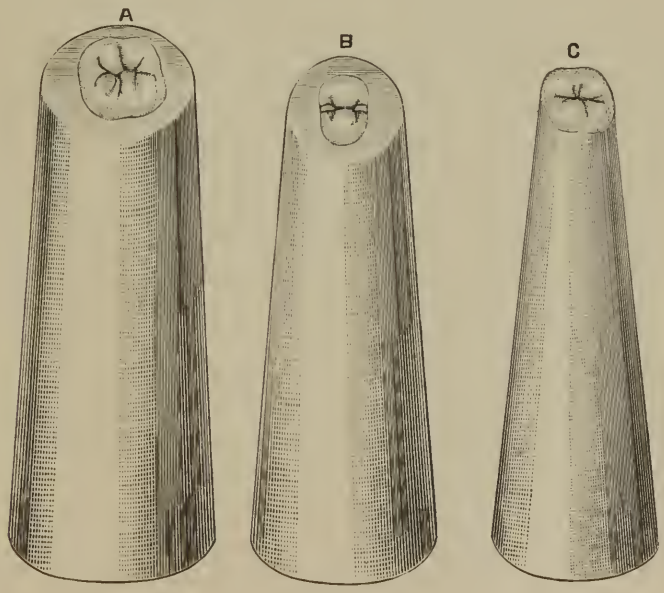
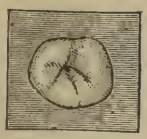


Fig. 86.

as shown at B, Fig. 85. We should have said that when the ferrule is

first made and fitted to the root end, the operator should ascertain the proper height of the band by letting the patient close the teeth, allowing sufficient space between the upper edge of band and occluding teeth for the soldering on of the cap of the crown. After the ferrule has been stretched on the anvil, as indicated at B, Fig. 85, it is again annealed and again contoured with the contouring pliers, as shown at C, Fig. 85. The cap (or cusps) is now made. Quite a number of devices for this work are on the market and for sale at the depots. To make these for one's self, extracted natural teeth, which are sound, or which may be made perfect in shape and contour by filling the decayed places with phosphate, cement or amalgam, may be placed on a glass slab with the crown downward, stuck into a small bit of wax to keep them in position. A small round pastboard box about an inch in diameter and two inches high may be placed over each tooth on the slab, by cutting off the bottom of the box and the whole inside of the box filled with plaster of Paris. When this hardens, the boxes are removed and the plaster trimmed to a conical form, leaving only so much of the cusps of the natural teeth which are imbeded in the plaster peeping out, as shown at A and B, Fig. 86. A number of them may be made of molar and bicuspid crowns, so as to have a selection of sizes to meet different cases, and if old natural teeth be not procurable these patterns may be made of porcelain teeth for vulcanite work, the carving of these being so close an imitation of nature as to subserve all the purposes for which they are needed as patterns for dies. The patterns being made, they may be sent to a brass founder, who will make accurate castings of them. It is well to instruct the brass founder of what kind of brass they should be made, as they have different formulas for making this metal, some formulas being intensely hard. The dies should be cast of *hard brass*. Some operators in having these dies made bring the plaster flush against the side of the tooth, as shown at C, Fig. 86. This plan is not as good as the other, for when the gold is stamped over the style of die A and B, the collar can be fitted into the depression with a little bending, while the part that is swedged against the shoulder of the die serves as a ledge on which to lay the solder to unite the two parts.

After the ferrule has been made, as described, the cap is then swedged; this is done by laying a piece of pure gold, of the same thickness or a little thicker than the ferrule, on a piece of lead and driving the die into it until the gold cap is driven up sharply into every indentation of the die. It may be well to caution the operator about this part of the work. As soft as pure gold is, it is liable to crack if handled roughly, and frequently we have had holes made into these caps because of not taking the necessary precaution of *frequent annealing of the gold*, as well as of not *coaxing up* the metal until it is led by degress into its new form. *Anneal frequently* and *stretch carefully* over all *elevations* on the die.



[Fig. 87.]

The cap as stamped up under the dies is shown in Fig. 87. The band, or ferrule, prepared as has been described, is now tied to this cap with *very fine* binding wire, as shown at Fig. 88. *Tight binding should be avcided*, and only *very fine* binding wire used, the object being merely to hold the parts in accurate relation, until the two pieces are bound together by the solder. With this, as in soldering all parts, the *fittings must be perfect* and the parts well painted with borax ground to a creamy condition with water. Before putting on the solder the parts should be heated red hot, so that the borax may melt; if the solder is put on at the same time with the borax, the water of crystallization, in passing out of the borax, causes the flux to swell up and expand, and when this subsides the solder may not be in the place it is wanted, or perhaps the sudden heating may cause the solder to fly off and leave the parts altogether.

[Fig. 88.]

The crown is now boiled in acid to remove the borax, after which it is filed up and finished. It may be well in doing this to fill the crown with *impression plaster*, mixed thin (which never gets very hard), to avoid the liability of bending the crown while finishing and polishing it.

Some operators prefer to fill the cap by melting gold of a lower carat into it, and thus to have the cap solid; but this may or may not be done. The occluding surface is just as hard when filled with cement as when made solid by filling with gold.

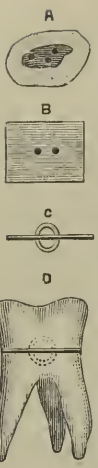
These crowns are inserted with Phosphate of Zinc Cement. The root is generally provided with a screw post or pin head, set in with Phosphate Cement, and the crown being larger within (at its occluding surface) than at its neck, when the two portions of cement, on the root, around the pin and in the crown, all coalesce into one mass, there is little liability of the one separating or dropping away from the other.

THE NATURAL CROWN SUBSTITUTE.

A SUGGESTION.

We offer the following suggestion, which may meet some cases. We term it "The Natural Crown," as it is made from the crown of a natural human tooth. It sometimes happens that for the relief of a crowded condition of the dental arch, a natural tooth is extracted without blemish; but even should it be decayed, this will be no hindrance to the operation, as the decayed places may be nicely burred out and filled to the proper contour with gold or amalgam.

We will take a typical case—an upper molar. The remains of the root are filed or ground down flat a little above the level of the gum. The roots are reamed out, cleansed, treated and filled, and the pulp chamber prepared, as shown at A, Fig 89. The crown of an upper molar of



[Fig. 89.]

the proper size and side is selected, filled in its decayed places (if necessary) and sawed off at its neck. The pulp chamber of this is likewise prepared by proper reaming with the burs in the dental engine.

We may say here that if any use is proposed to be made of *old extracted human teeth* they should be kept in a glass jar submerged in *a strong brine*, or preferably in a jar of alcohol. If allowed to become dry after extraction they get so brittle that nothing can be done with them in the matter of cutting, reaming or preparing them for filling.

When the roots and crown are prepared as described, the pulp chamber of the crown is filled with wax and placed in position on the root, and the proper occlusion is thus obtained. This being done, the crown is filed or ground down, at its neck, about the thickness of a card-board or a little more, so as to shorten it this much, for reasons that will be apparent. A piece of gold plate of 18 karat fineness, and about 28 or 30 thick, and of a size that will amply cover the neck of the crown, is punched with the plate punch with two holes about 1-32 of an inch apart, as shown at B, Fig. 89. These holes are countersunk. A piece of wire, bent like a staple, is passed through these holes and soldered to the plate with two minute pieces of solder flowed into the countersunk holes, and the protruding ends of the wire on the other side of the plate are bent so as to form another staple or loop, as shown at C, Fig. 89. The plate as thus constructed is filed to the proper size, as indicated by the size of the neck of the crown or root. The root is now well dried, and the proper provision made for the exclusion of moisture. The pulp chamber is filled with Zinc Phosphate Cement and a little of the same placed within the loop on the plate. The plate is placed on the root and kept in close contact with it until the cement sets. The crown, in its pulp chamber, is then filled with cement, a little placed within the loop of the plate, which was cemented to the roots, and the crown carried to its position. After the cement hardens, the operation is completed, with the exception of scraping such small portions of the cement as oozed through. There is nothing to tell this from a natural crown substitute except the line at the gum margin showing the plate which binds the roots and crown together, as shown at D, Fig. 89; the dotted lines showing the staples on the plate imbedded in the cement.

MELOTTE'S MOLDINE.

The making of dies and counter-dies *promptly* is quite an important consideration in many operations connected with laboratory work, and much credit is due Dr. Melotte for his valuable suggestions in this direc-

tion. The moldine which is offered for sale under the name of "*Melotte's Moldine*," is quite serviceable when it is necessary to have a die and a counter-die, and with it these may be made almost as promptly as the making of a plaster model. We do not know of what the moldine is composed, but believe it to be "Fuller's earth or pipe clay mixed with glycerine to the consistency of putty." For making crowns, repairing a cracked plate and many other operations of the laboratory, this material will save much time and very many useless and vexatious efforts. Thus in repairing a cracked plate, it is difficult to bend a piece of plate over the crack so as to assist the solder (which should never be depended on *alone* to remedy and strengthen such a disaster) in giving stability to the repair. True, a piece of thin platinum, or thin pure gold plate, may be burnished over the crack and be made to fit *approximately* well for the repair of such cases, but a piece of gold plate *of lower karat* swedged to fit over the crack makes a better and more substantial job *and easier soldering*. We give below formulas for making die metals which melt at different temperatures. They will be found serviceable for the die and counter-die:

No. 1. Melts at 212° F.

Bismuth	2 parts.
Lead	1 part.
Tin	1 part.

No. 2. Melts at 176° F.

Bismuth	20 parts.
Lead	12 parts.
Tin	7 parts.
Mercury	4 parts.

No. 3. Melts at 151° F.

Bismuth	7½ parts.
Lead	4 parts.
Tin	1½ parts.
Cadmium	2 parts.

No. 1 may be used for the die, and either No. 2 or 3 for the counter-die. It is well always in making a counter-die to take the precaution of painting *the face of the die* with thin whiting and water and of drying this before pouring the metal for the counter-die, as also in pouring the counter metal, when this is nearly cold.

Fig. 90 represents a cracked plate invested for repairing the crack. A piece of plate, P, is (preferably) swedged to fit over the crack and held in

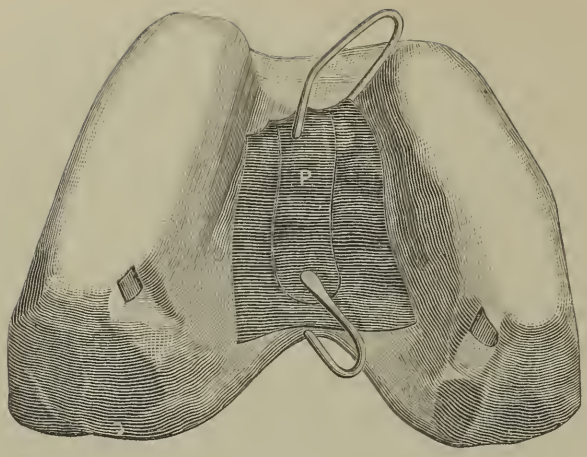


FIG. 90.

position by two iron wire clamps; one of these is made like the one represented at Fig. 43, which is applied towards the roof of the mouth, and holds the swedged piece immovably at that point, while another, made of iron wire like Fig. 91, is placed towards the buccal or labial surface of the plate, which holds the swedged plate securely at this point. These clamps are applied *before* the plate is invested; the plate having been boiled, first in a strong solution of soda and water, and next in a solution of sulphuric acid and water. Both the plate and the swedged piece should be well scraped so as to free them *of every particle of dirt or grease.* Before applying the swedged piece, the *plate* should be painted with a creamy solution of borax and water, and the *swedged piece* also. The clamps are then applied, and the piece with the clamps in position is invested, as shown in Fig. 90.

FIG. 91.

Cases occur in making a metal crown for a root, either in the upper or lower jaw, that from the long loss of the crown of the antagonizing tooth has grown so long (from the lack of antagonism) that we cannot supply the substitute to its original length. It is in such cases that Dr. Melotte's Moldine comes in for special service. The root being prepared and a ferrule fitted to it (the ferrule) is filled, while in the mouth, with adhesive wax, The patient is directed to close the teeth and the antagonism or occlusion is taken, the surplus of adhesive wax is neatly cleared away from around the ferrule and its edges. The adhesive wax is still further dressed away, to allow for the thickness of the cap which is to be soldered to the ferrule. The wax is then well chilled with iced water. It is then dried, and the parts being protected from saliva with a mouth napkin, the teeth and adjacent gums are carefully dried and the parts sprinkled with fine powdered French chalk or soapstone from a bottle

with a perforated cover, like a pepper cruet. To do this sprinkling in the *upper jaw* one of the small bellows, such as is used for sprinkling insect powder in cracks, will be found to work effectively. We now take an impression of the parts *with moldine.* To do this, improvise an impression cup out of a piece of sheet brass about an inch wide and about three inches long. Bend it, as shown in Fig. 92, and place the moldine within at C; then take the impression. When the impression is taken, scrape off carefully any of the moldine that has been pressed outside the margins of the impression cup, and with a wax spatula or the blade of a penknife fill up, on each side, the impression cup at the points marked A and B, so that should any of the die metal run over, it will not enter these points. A piece of large rubber tubing, about 1½ inches long, may be stretched over the impression and cup, as shown at Fig. 93, and any place within the ring where the melted metal might run should be filled with moldine. In the absence of large rubber tubing, the moldine may be kneaded into a strip like a piece of base plate wax (only rather thicker), and this strip used to encircle the impression within the impression cup. This may be still further strengthened and held into shape by wrapping a strip of paper several times around it before pouring the die metal

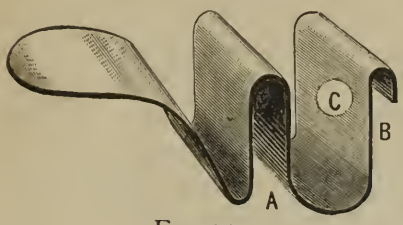


FIG. 92.

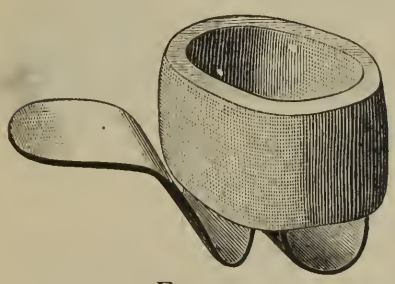


FIG. 93

With the die and counter-die made, a cap can be swedged to fit over the ferrule, which was fitted around the root, soldered, finished and afterwards inserted.

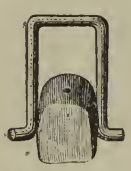
REPAIRING.

Cases frequently come in which require repair. One of the most frequent is the breaking off of the dowel in the root. This is especially the case in such crowns as are explained at page 48. The crown is in all respects perfect, but the pivot is broken off. The procedure for repair is as follows: The fractured part of the pivot is filed flat, next the under side of the face plate, and a minute hole drilled in the centre of where the old pivot stood This hole should be about the 1-32 of an inch deep, and *well countersunk.* A piece of gold wire of the proper size, and a trifle larger than the old pivot, is put in the chuck of the lathe, and the end

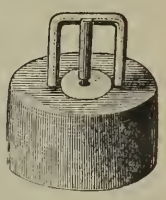
[Fig. 94.]

turned or filed, as shown in Fig. 94, of a size to fit into the hole that was drilled into the face plate, as shown at A. The upper end is notched, as shown at B, Fig. 94. A piece of iron wire is bent, as shown at Fig. 95. The crown is slightly warmed, and a film of adhesive wax placed on each side of it. The piece of wire, Fig. 95, is likewise warmed, and the crown placed between the arms of Fig. 95, as shown at Fig 96. The point of the dowel, A, Fig. 94, is then entered into the hole of the face plate, and the top bar brought down into the slot or groove of the dowel, B, Fig. 94. The crown, while held, as shown in Fig. 96, may be passed to and fro quickly through the blaze of the spirit lamp, so as to slightly soften the adhesive wax, to enable the workman to press the bar down into the groove of the dowel, B, Fig. 94. The case is then invested, as shown in Fig. 97. A small piece of solder is placed at the point of the dowel that enters the hole in the face plate, sufficient to fill the countersink when it is soldered.


[Fig. 95.]


[Fig. 96]

After trying it into the root, should the *direction* not be exactly correct, the dowel can be bent slightly, if it is done carefully.


[Fig. 97.]

CHAPTER VIII.

For many years the only means of soldering was by the aid of the mouth blow-pipe. This was considerable labor. The self acting blow-pipe was considered quite an aid in the work; but the aid lay more in heating up the work, for with it no pointing of the blaze could be done. Just as much could be effected, and effected better, by gathering a few pieces of ignited charcoal in a soldering pan or furnace, such as is shown at Fig. 29 (though such an appliance was not for sale at the depots at the time to which I refer, and each dentist had to have a pan or holder made at the tinsmith's, according to his own ideas), and on these laying the invested work. After which more charcoal was filled in all around the work, and this was fanned until all was a glowing mass. To some extent the same manner of procedure is observed at present, although the operation of soldering is not attended with the labor that it was then

We propose in this paper to describe the construction of a serviceable blow-pipe and bellows to be used with it. To those who can afford it, we would say *purchase one*; but to the young dentist, fresh from graduation, who will doubtless have much spare time on his hands, he may be able to make one from our description, for perhaps one-third the money it will cost to purchase.

Procure two boards of any kind of hard wood—black walnut will answer well. The boards should be 10 x 11 inches in measurement,

and ⅞ of an inch thick. Both these boards are rounded on one end, as shown in Fig. 98. In the Board A a hole is bored, as indicated at H, over which the valve of the bellows plays. This hole should be about 1½ inches in diameter. It is bored midway from the sides of the board, and the outer edge of the hole should be 2½ inches from the square end. This board forms the *bottom* of the bellows. The hole over which the valve plays should be covered with a piece of wire gauze, to prevent the admission of

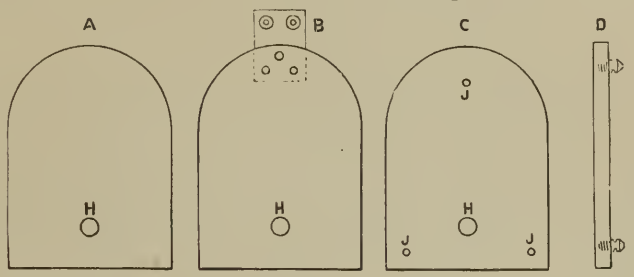


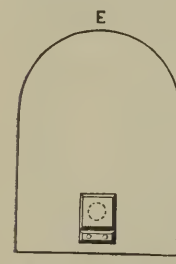
FIG. 98.

large particles of dirt or lint, which, without this precaution, would interfere with the working of the valve. At the rounding end of this bottom board, a piece of iron 5 inches long, 3 inches wide, and ¼ inch thick, is screwed to it, as indicated at B, Fig. 98. Two holes are made in the protruding end of this piece of iron, by which it may be screwed to the floor. But if this be not desirable, and the operator wishes to have the bellows movable, so that he may use it from place to place, such a piece of iron for the bottom board is not necessary. It is important, however, that this bottom board be lifted a certain distance from the floor, as without this the air would not be admitted to the valve hole freely, and besides, such close proximity to the floor would soon fill the interior of the bellows with dust, which would be sucked in. For this purpose three large wood screws may be used. They are screwed into this bottom board a little over a half-inch (*not* sufficient to let the end of the screw perforate the board), and in the position indicated at J. J. J., Fig. 98. When the screws are fixed into the board in the position indicated, they

[FIG 99]

are unscrewed, and a little more than a half-inch of the screw part of each screw filed off, and the head of the screw is also filed off from the shank, to the length of about ¾ of an inch. The end of the shank is then sharpened with a file (or in a lathe) to a point, and a slot cut into the shank, so that a wrench may be used to put the screw back into the bottom board. The manipulation of the screw, as described, is shown in Fig. 99, and the way they appear when screwed into the bottom board is shown at D, Fig. 98. It will be seen that by these screws the bottom board of the bellows is lifted about ¾ of an inch from the floor. The object of sharpening the ends of the screws is for the purpose of keeping the bellows from slipping when the

foot is applied to the upper board. The valve consists of a piece of soft leather, to which two pieces of wood are attached. It is shown at Fig. 100. These pieces of board for the valve need not be more than ½ an inch thick. They should be glued to the leather, and they should be beveled, so that the lifting part F will have free motion over the air hole in the bottom board. The other part of the valve board should also be beveled, and is perforated with two holes, that it may be screwed to the bottom board, as shown at E, of Fig. 100. The valve should be sufficiently large to cover the air hole in the bottom board by at least ½ inch on *all* sides. To make a more perfect fit of the valve over the air hole, that part of it marked F, may be weighted by screwing to it a piece of thick sheet lead with small ½ inch screws. This will be all that is needed for the bottom board.



[Fig. 100.]

The top board is another piece exactly the same size, shape, and thickness as the other, as shown at A, Fig. 101. It is perforated also with a hole about 1½ inches in diameter, as shown in the cut at K.

A circular piece of board, 9 inches in diameter, and 1½ *inches* thick, is next made, as shown at C of Fig. 101. This circular piece is grooved deeply (preferably in a lathe), as shown at D, Fig. 101,

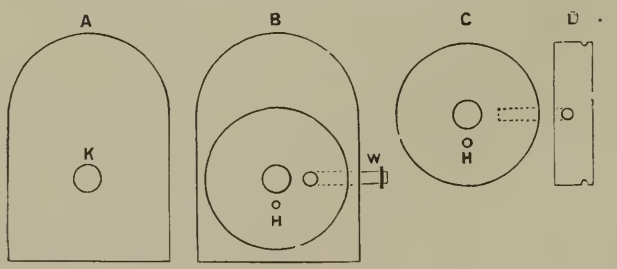


Fig 101.

or in the absence of a lathe, the groove may be made with a saw and wood rasp. Into the side of the circular piece a hole is bored ⅜ of an inch in diameter, as shown by dotted line at C and D, Fig. 101. The object of this hole is to accommodate a piece of brass tubing ⅜ of an inch in diameter and about 4 inches long. On this piece of brass tube a piece of brass wire may be soft soldered, on the end that protrudes from the bellows, so that the rubber tubing that fits over it when it is in use may hug the brass tube tighter, as shown at W of B, Fig. 101, also at W, Fig. 105. Before driving the brass tube into this hole, another hole is bored at right angles with it, so that the two holes meet, as shown by the dotted lines at D, Fig. 101. A hole 1½ inches in diameter is bored in the circular piece, as shown at B and C, Fig. 101. This hole should have no connection with the small hole bored in the side of the circular piece for the accommodation of the brass tube.

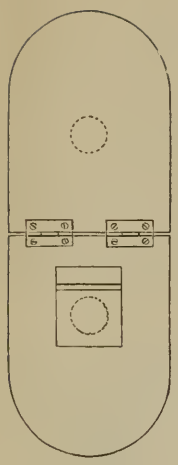


FIG. 102.

Having proceeded thus far, the top and bottom boards are hinged, as shown in Fig. 102.

It will be better before making *the large hole* in the top board (shown at K in A of Fig. 101) and in the circular board, to assemble these parts.

The circular board C, Fig. 101, is glued to the top board, as shown at B, Fig. 101. The large hole is then made *through both boards* The small hole in the side of the circular board should be made *before* this is glued to the top board. The intersecting hole is likewise made through the top board until it unites with the small hole in the circular board.

A valve is made to fit over this large hole. This is a simple affair. It consists of a piece of soft leather, to which a piece of board is glued or tacked with small tacks The board should be about ¼ inch thick and sufficiently large to cover the hole ¼ of an inch over its entire circumference. The leather should be sufficiently long to extend backwards so as to form a hinge. This valve lifts upwards, like the lower valve, and is shown in A, Fig. 103, as well as in Fig. 107. There is a small hole made in the circular board, shown at H of B and C, Fig. 101, that will be explained further on.

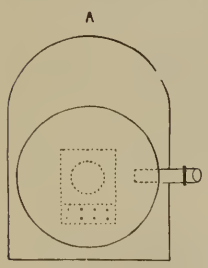


FIG. 103.

A piece of iron, 3 inches wide, ¼ inch thick, and 7 inches long, is bent at right angles, something in the shape of the letter Z. This is screwed to the round end of the top board. It is for the purpose of placing the foot on when working the bellows. See Fig. 104. Two holes are made in one end of it, so as to screw it to the top board.

FIG. 104.

A bed spring is next secured to both the top and bottom boards, as shown in S, Fig. 105. As an explanation of this cut we will say G represents the iron foot piece, L the large hole made through both the top and circular boards, over which T, the top valve, plays. H is the small hole made in the circular board, into which the brass tube is fitted. C is the circular board, which is glued to the top board, through both of which the large hole passes, and into the side of which, H, a hole is made for the brass tube, and which is furnished with a deep groove, J. A is the top board, B the bottom board, V the lower valve, L the hole in the lower board over which the valve V plays. F F the feet (3 of them, 2 on the square and one on the round end of the bottom board), K

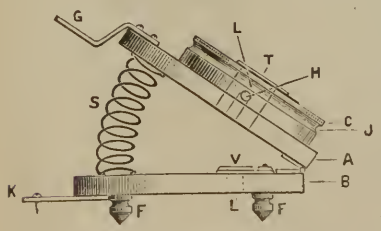


FIG. 105.

a piece of iron (already described) designed to screw the bellows to the floor. If not used, the bellows should be provided with feet, F.

[Fig. 106.]

The parts being assembled, as shown, a heavy piece of sheepskin, 30 inches long, 7 inches wide at its greatest diameter, and tapering 2 inches at its smallest, is used to unite the top and bottom boards of the bellows, cut in the shape as shown at Fig. 106. The spring, hinges and lower valve should be carefully secured, because once the bellows gets its covering of sheepskin, these parts are inaccessible.

To apply the sheepskin, the top and bottom boards are brought together as close as the spring will permit, and are held thus with one, two or three clamps, such as carpenters use when gluing. The sheepskin is glued and tacked to one board at a time, beginning at the square end and going all around, gluing the sheepskin and tacking it at frequent intervals as you proceed. The same procedure is observed for the other board, and an extra piece of sheepskin is glued to the hinged end for additional security against leakage. When it is all glued, a strip of leather about a half-inch wide is tacked over the sheepskin to the edges of the top and bottom boards, with small gimp tacks, for the purpose of a finish.

Before tacking down the top valve, which rests on the circular board, a small hole is drilled about ¼ of an inch in diameter (see H of B and C, Fig. 101) and a half inch deep into the circular board, about ¾ of an inch from the outer circumference of the large hole. The object of this hole is to give place to a delicate spiral spring which presses the top valve *upwards*, as shown at A, Fig. 107.

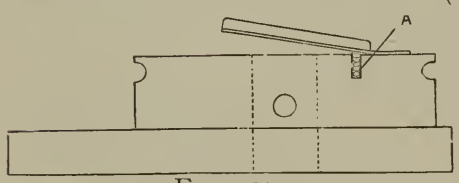


Fig. 107.

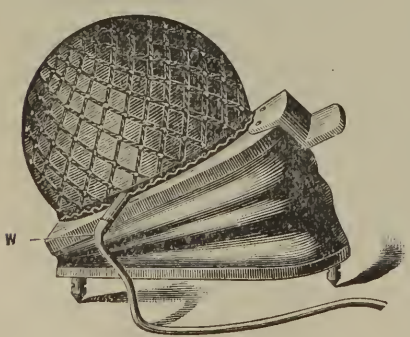


Fig. 108.

All that remains now to be done is to secure *two or three thicknesses of thick rubber dam* to the circular board. These are cut in the form of circles, with enough to spare that it may be tied into the groove of the circular board. It is best to tie each piece of the dam separately, and with a slip-knot in the twine. The final operation

is to tie on the *scoop net.* To do this, the twine is passed *in and out* through the *lower meshes* of the net, when it is applied to the groove of the circular board and therein tied securely. The bellows, when finished, is represented at Fig. 108.

To make a gas blowpipe, we proceed as follows: A piece of seamless brass tube is obtained, about 3/8 of an inch in diameter. This is annealed,

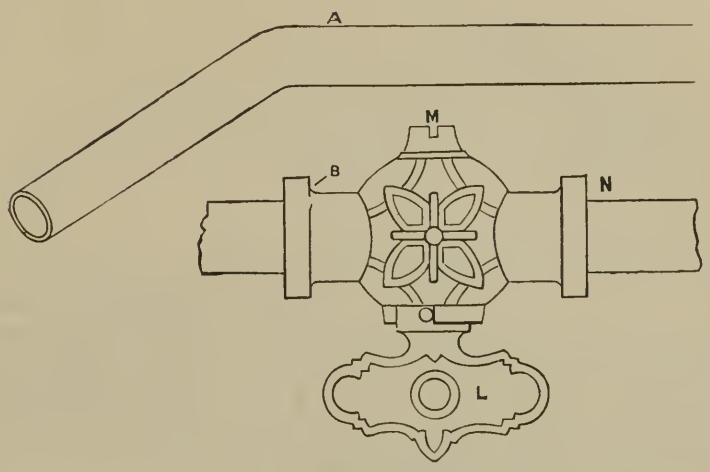


FIG. 109.

and when cold it is bent, as shown at A, Fig. 109. On the other end a gas key may be soldered with silver solder, as shown at B, Fig. 109, and at K, Fig. 112. Before soldering this gas faucet, the key L should be removed by taking out the screw M, which holds it in place A short section of tube is soldered to the other end of the faucet, as shown at N, Fig. 109. This key is not essential to the gas blowpipe, but it will be found very serviceable in decreasing the flow of gas when it is necessary to point the blaze. The bent end of the large tube is drilled with a small hole at the point marked A, Fig. 109. At page 44, Chapter V, we gave the manner of making small tubing.

A piece of this small tubing is taken (about 3 inches of it), and where the seams of the metal come together it is carefully *hard soldered* with silver solder. The size of this tube should not exceed 3-16 of an inch in diameter; a smaller size is preferable. The hole drilled into the tube at A, Fig. 109, should be increased in size, with 5-sided reamers, until the small brass tube fits into it *snugly.* This small piece is then bent near the end, as shown at A, Fig. 110, and a piece of brass plate soldered to it, as shown at B, Fig. 110. To avoid repetition, we will say that all the soldering is to be with hard solder (silver solder is best used on brass) unless otherwise specified.

The small tube is then soldered to a washer, D, Fig. 110, and this

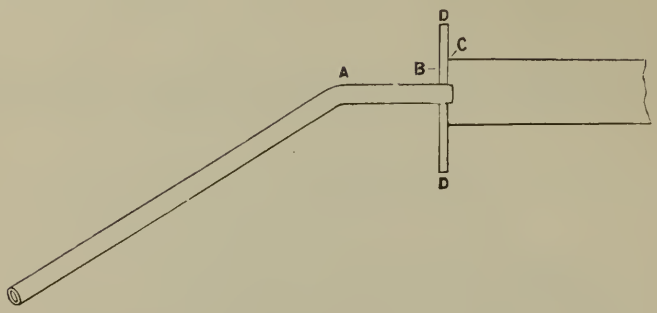


FIG. 110.

washer soldered to the large tubing, as shown at C, Fig. 110. The large tube is the same size as that shown in Fig. 109. After soldering, the ends, D D, Fig. 110, may be filed off level with the large tube. The large tube, thus soldered to the small tube, is now bent at its end, as shown at E, Fig. 111. This being done, the two parts are assembled. The small tube F, of of Fig. 111, is passed into the hole made for it at A, Fig. 109, and the two parts bound together with binding wire, as shown at JJ, Fig. 112. The parts which

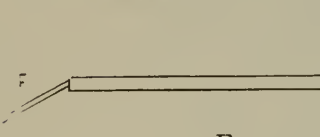


FIG. 111.

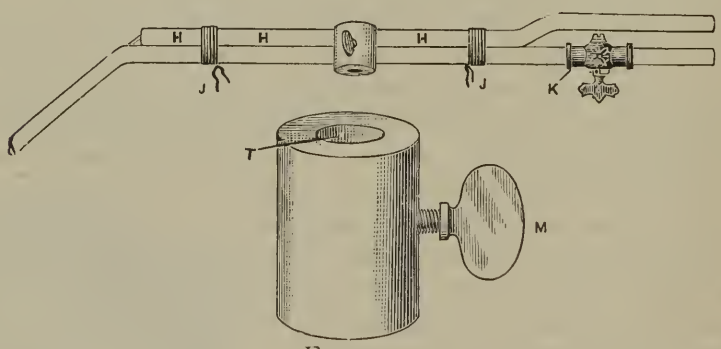


FIG. 112.

were previously soldered, and the parts H H H, where the two tubes are brought close together with the binding wire, Fig. 112, are well coated with borax and water ground to a creamy consistency. These parts

should be scraped clean before the tubes are bound together, after which they are soldered. The upper tube is for the air supply, the lower for the gas supply. A sectional view of the blowpipe is shown at Fig. 113 The end of the small tube, which passes through the large tube, should not

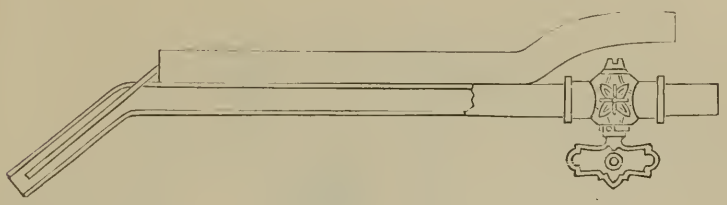


Fig. 113.

extend beyond it, but be a little short of it, say about 3-16 of an inch from the end.

Before removing the binding wire, shown at J J Fig. 112, it is desirable to solder on the blowpipe a piece of thick brass tube about an inch long and about ⅛ of an inch thick, having a bore of about a half-inch. This piece of tube should be prepared, however, before it is soldered. A hole should be drilled in the side of it, and this hole tapped with a screw thread. A thumb screw is then fitted to it. The position of this is shown at Fig. 112 (upper cut) and the piece of tube with the thumb screw is shown at M of the lower cut. This tube is soldered to the blowpipe by binding it in position with binding wire. The blowpipe is then finished. A standard is then made for its support. This is a simple operation. A piece of brass rod slightly smaller in diameter than the bore of the brass tube T, Fig. 112, about twelve inches long, is used. About one inch of moulding sand is packed, moderately tight, in one of the largest of the casting rings. The brass rod is *deeply* nicked with a file, in several places, *about one inch* from one end, and this end is sunk perpendicularly into the sand of the moulding ring, and with any arrangement found available the other end is supported, so it will be perpendicular. Lead is then melted and poured into the casting ring to the depth of about 1½ inches. When cold the protruding end of the brass (which was sunk into the moulding sand) is filed off. This makes a standard as shown in Fig. 114. The blowpipe is then passed over

Fig. 114.

the standard through the piece of brass tube soldered to it at Fig. 112; when it may be held at any convenient height by means of the thumb screw attached to this tube. In use, the air from the bellows and the gas from the burner is conveyed to it as shown in Fig. 115.

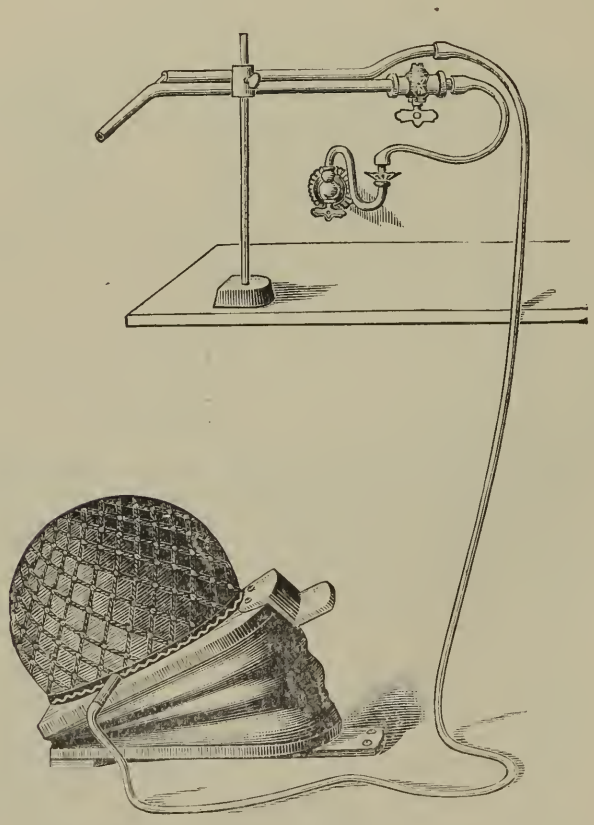


Fig. 115.

We propose now to go into the description of how to make a blow-pipe furnace, as well as a larger furnace of the same kind, by aid of which small quantities of gold may be melted in the former, and zinc, lead, tin or Babbitt metal in the latter. These appliances will be found very useful in the dental laboratory. We will describe the one for melting zinc first :

Procure an old iron, six-quart, plaster can ; see Fig. 116. Remove the cover, and have a tinman to cut it off all around about 2 inches from the top. If the can is not rivetted where the two ends of the metal meet this should be done. If it is only lapped, the lapped ends should be well hammered together, so there will be no danger of their pulling apart. A hole should also be cut in the metal about 2 inches in diameter, the centre of the hole being 1 ½ inches from bottom of the can, all as indicated in Fig. 116.

Equal parts of Powdered Asbestos, Kaolin Clay, and Plaster of Paris are mixed with water to the consistency of a thick Paste, and the bottom of the can packed with this to the depth of an inch. A large bottle or jar is now procured, not less than 5 ½ inches in diameter (one with the bottom receding inwardly is preferable). The receding part of the bottle having been oiled, is filled with the Plaster, Asbestos and Kaolin, and it is then inverted and put in the center of the can and slightly moistened so that the mixture in the can will unite with that which was put in the receding part of the bottle. The sides of the can are then filled and packed, with the same mixture, by the aid of a stick, as shown in Fig. 117, the hole made in the side of the can being plugged with a round stick an inch in diameter, to prevent the mixture from escaping at this point. As the hole in the can was cut 2 inches in diameter a piece of sheet iron having a hole cut into it one inch in diameter should be placed over the plug as shown in Fig. 117. When the can is filled, the bottle or jar is loosened, and carefully withdrawn, and then the wooden plug is removed. It is well to oil the sides of the bottle to facilitate its withdrawal. Any imperfections that may exist in this luting or plastering of the can may be rectified by the addition of more material at the defective places by means of a spatula. Should the receding part of the bottom of the bottle or jar be too high some of the material can be taken off and leveled, as shown by the line at the bottom of the can in Fig 117. The top of the can is now filled with the same material, a stick or the large handle of an instrument, about 2 inches in diameter, and tapering, being placed in the center of the top of the can so as to form a hole in it. The melt-

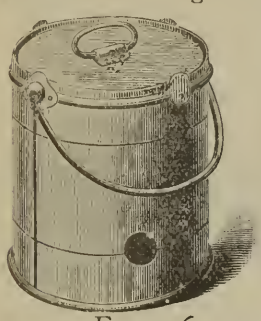


Fig. 116.

Fig. 117.

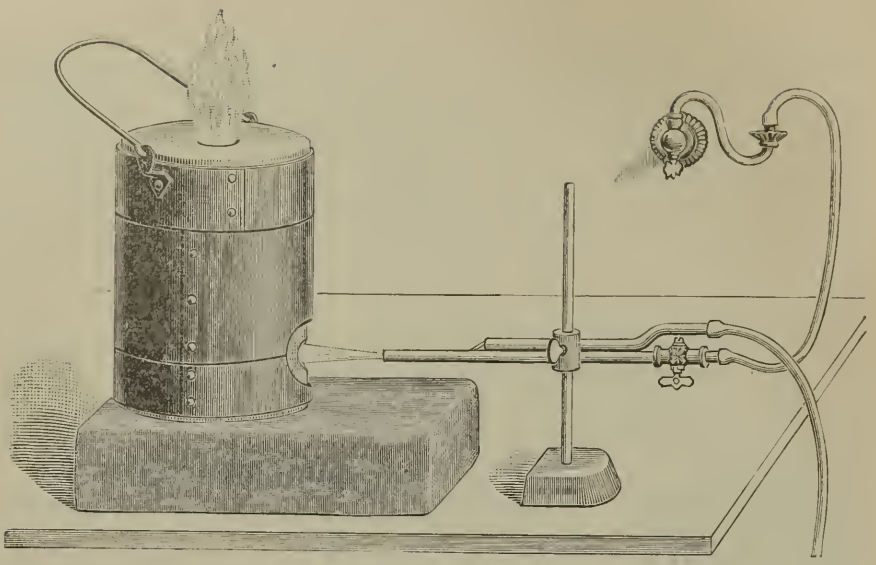


Fig. 118.

ing furnace when complete is shown at Fig. 118, and Fig. 119 gives a sectional view of the same. The construction of a blowpipe furnace for melting gold is carried through in precisely the same manner, only that instead of using a plaster can, a tomato can will be found sufficiently large. Instead of being soft soldered however, the laps of the can *must be rivetted.* In mixing the Plaster, Asbestos and Kaolin, it may be well to mix it in the given proportions *several times*, as, if mixed in the quantity necessary for the whole job, it may set or harden before completion. With two furnaces such as we have given the description of, the young dentist will be well provided for doing nearly all the work that may offer where strong heat is required.

Fig. 119.

Since writing the above description of how to make a furnace, we have been experimenting on these, and we have found that in one or two points the manipulation can be improved. For instance, instead of making the furnace in two parts (as described) it is easier and better made in three parts. The can therefore should be cut as shown by the lower line in Fig. 116, and this part packed with the fire clay mixture mixed to the consistency of a thick paste The top part, to which the handle of the can is affixed, as shown in Fig. 118, may also be filled with the material mixed to the same consistency. But the middle part, in which the jar or bottle is used to form this part into a cylinder, may be done better, as

will be here described. We found that although the jar or bottle was well greased on the outside for the purpose of releasing, that it was held immovably within the cylinder, and the only way we could get it out was to break it up. We therefore devised another plan. We took a piece of sheet zinc the necessary height and bent it round, lapping the ends, and securing this of the requisite size or diameter by binding it with fine binding wire. We place this binding wire in three places, one piece at each end of the zinc roll and the other piece in the center. With this arrangement, placed within the can, we used it as a core, and packed the Asbestos, Kaolin and Plaster around it, and in doing this we found that it was preferable to mix these materials to the *consistency of cream*, instead of mixing them as thick as paste; for in this condition these materials could be *poured* between the zinc core and the can with more facility and with fewer flaws, than it could be done in a pasty or putty-like condition. When the material *set hard*, the edge of the roll of the zinc core was seized with a pair of large flat-nose pliers and twisted inwardly, and in this way the core released with facility.

FIG. 120.

What we mean by making the furnace in *three parts* instead of two, will be better understood by Fig. 120 Here it

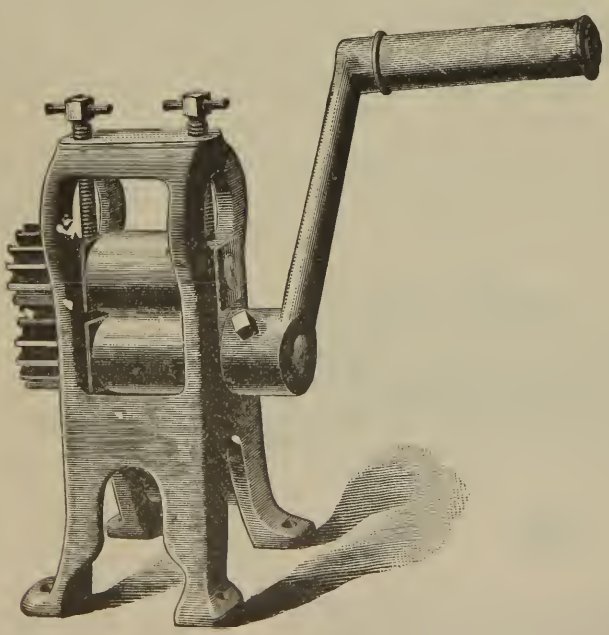


FIG. 121.

is shown that the *lower* part of the can is cut off, and this part packed

as indicated. The middle part is packed as described with the sheet zinc core, and the upper part or cover as described for that part.

We understand that Dr. Rosenthall, of Cincinnati, O., has devised a very useful appliance for the laboratory. This consists of a "Lilliputian Rolling Mill." The rollers are two inches long and one inch and a half in diameter The whole weighs about twenty pounds and is set in a strong frame. It is as efficient as a large mill for working small quantities of metal, and is sold at the very reasonable price of fifteen dollars. Fig. 121 shows these rolls.

By means of the standard shown in Fig. 114 the gas blowpipe can be depressed sufficiently that the flame may play through the holes of the furnace we have described.

For this use, however, a blowpipe would have to be made with a *straight nozzle*, as shown at Fig. 118, instead of being bent as the one is that we have described at Fig. 112. It is well to let the Plaster, Asbestos and Kaolin dry well before using, and when first used to heat it up gradually.

CHAPTER IX.

REMOVABLE BRIDGEWORK.

In the March number of the Dental Cosmos for 1889 there appeared an article by Dr. H. A. Parr, of New York, on "Removable Artificial Dentures," which appeared to us as being a valuable improvement on the fixed Bridgework, which is so much in vogue at present. Apart from the great consideration of cleanliness, the strain of the denture is not borne entirely by the teeth used as buttresses, but a part of the burden is borne by the gums as well.

Having a case in which the patient was sadly in need of some antagonizing teeth, and one which seemed to indicate the employment of just such a plan as was proposed in the article by Dr. Parr, we proceeded to construct such a denture.

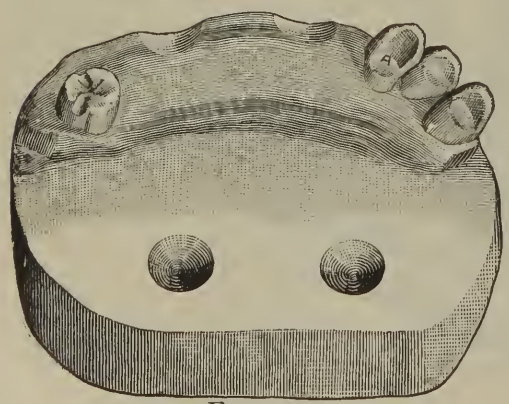


FIG. 122.

The patient had not lost any of his lower back teeth, but the space from the right upper cuspid to the third molar was edentulous. He had made such vigorous use of his teeth that the occlusion was so close that the thinnest tissue paper could not be placed between the occluding teeth. The incisors of the upper jaw were worn into grooves and gullies on their

palatal aspects by the attrition of the lower teeth. Fig. 122 represents a model of the case. It was useless to endeavor to cut the cuspid so as to put a gold cap over it, as the lower opposing tooth closed on it like a pair of shears. The third molar, too, was in a like dilemma.

But we propose in this to relate how we proceeded in this case from the inception to the end.

Our first procedure was to dress off the distal surface of the cuspid, near its cutting edge, so as to make the tooth as parallel as possible, and next to grind a groove on the palatal aspect of the same tooth, A, Fig. 122.

Fig. 123.

The 3d molar was likewise dressed away on its distal surface to make this tooth also of easy draft. The palatal and buccal fissures were also deepened by grinding the teeth away in these places with small corundum wheels. The enamel was not cut through in any of the dressings made on these teeth.

Fig. 124.

Our next procedure was to take, *separately*, plaster impressions of the cuspid and 3d molar. From these impressions we made models, and from the models dies, on which we fitted and swedged very accurately, a band to encircle the molar, to which we soldered pieces of wire that fell into the grooves cut on the buccal and palatal fissures of this tooth, as shown at Fig. 123 The cuspid was fitted with a half cap, as shown at Fig 124, a small spur being swedged down into the groove, as shown at A, Fig. 122. We next made a box of gold by bending a piece of gold plate 1/8 of an inch wide, around a piece of square steel wire, as shown at Fig. 125, which we attached to the ring with hard wax. Our next procedure was to make the spring catch which was to fit into this box. This was made of a piece of springy platinized gold bent in the form of a letter U, as shown at Fig. 126. A piece of stout round gold wire was bent, as shown at Fig. 127, and so filed that one end would fit over the spring catch, Fig 126, to which it was wired and soldered, as shown at Fig 128. It was now tried into the box which had been fastened to the collar around the molar, Fig. 129, while the other end was filed until it fitted well on to the half collar on the cuspid tooth, Fig. 124. This end was then fastened to this collar with adhesive wax, when it was invested and soldered, as shown in Fig. 130. Before these manipulations were begun the teeth had been ground, fitted and articulated, as shown in Fig. 131. The object of this being to determine where to solder the box on the

Fig. 125.

Fig. 126.

Fig. 127.

Fig. 128.

Fig. 129.

Fig. 130.

collar on the molar tooth. The box on the molar was invested and

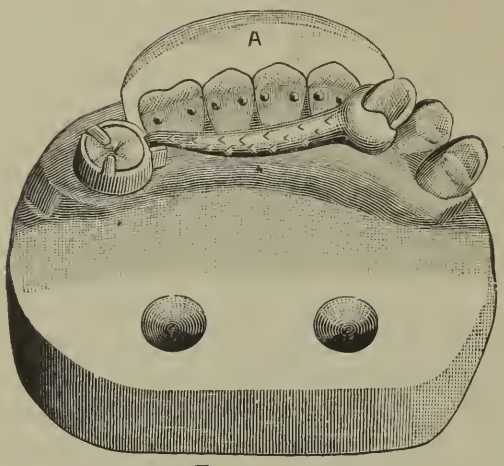


FIG. 131.

soldered to the collar, Fig. 129. Molar teeth and bicuspids were found to be too thick, so that cuspids were used in place of bicuspids, and a facing molar, with long pins, was used for the molar tooth. The teeth were held in position while the gold work was being prepared by casting a plaster matrix on the front faces of the teeth, as shown at A, Fig. 131. The gold work being all prepared, the case was waxed up, flasked, and vulcanized. The appliance when complete is shown at Fig. 132.

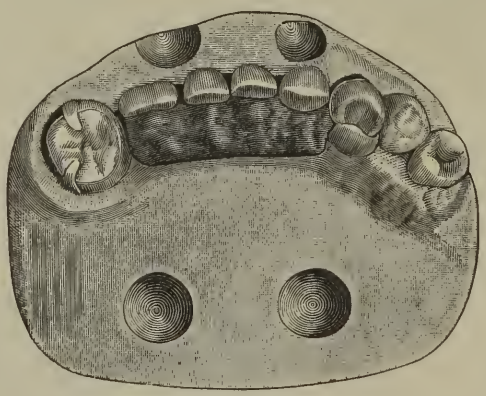


FIG. 132.

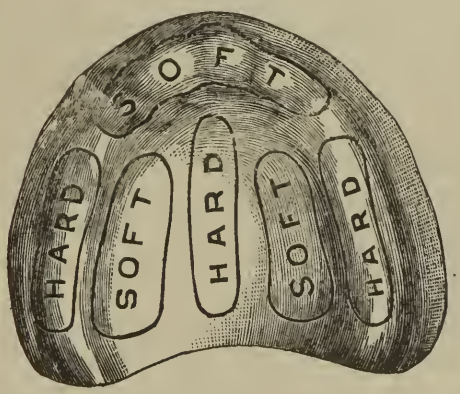
CHAPTER X.

VULCANITE WORK.

TAKING THE IMPRESSION OF THE MOUTH.

The patient being seated in the operating chair, the first effort will be the examination of the mouth, to ascertain where the hard and soft places

are located. It will generally be found that along the ridge, from the heel of the jaw, or maxilary tuberosity, for about an inch to an inch and a half on each side, running forward, will be hard. This hard surface will be ordinarily about one-eighth to three-sixteenths of an inch in width. Along the medium line, there will likewise be found a hard surface extending backward from the rugae to the soft palate, more or less wide, and varying in shape. These are generally the hard places The soft places are found between the ridge and the median line, on each side, and the forward part of the ridge in the space occupied by the eight front teeth, namely: The four incisors, two cuspids, and two bicuspids of the upper jaw. To make what we have described perfectly clear to the student, we have prepared a cut of the mouth indicating where these hard and soft places are usually found.



[FIG. 133]

The mouth being examined, the next thing will be the selection of a properly shaped and sized impression cup. The impression cup should be somewhat larger than the gum it is to enclose. It should be about one-quarter of an inch wider and longer than the mouth; that is, one-eighth of an inch to spare on each buccal surface; one-eighth of an inch in front or on the labial surface, and about one-eighth of an inch beyond the hard palate. The sides of the cup should be depressed in the neighborhood of where the bicuspid teeth would be, rising at the point of the canine fossa, and also well over the maxilary tuberosity. That part of the cup, also, which rests or approaches the soft palate should be bent or turned upward, so as to prevent, as much as possible, the escape of the plaster of Paris, when this material is used to take the impression.

There are some operators who give the preference to clean, fresh, yellow beeswax to take impressions of the mouth; others to modeling composition. If the former be used, it is softened in warm water of the

temperature of 130° Fahrenheit. It will not do to have the water hotter and put the wax in it, and if found too hot to add cold water so as to reduce the temperature of the water. If this be done, the wax will first be melted and when the cold water is added, the melted film of wax floating on the surface of the hot water will be seized and suddenly chilled. This will render the wax granular and not homogenious, and unfit for taking the impression. It is better to plunge a thermometer in the water, and if the mercury rise above 130, then to add cold water until the water is reduced to the necessary heat, when the wax may be introduced. If modeling composition is used, the water may be brought nearly to the boiling point to soften it.

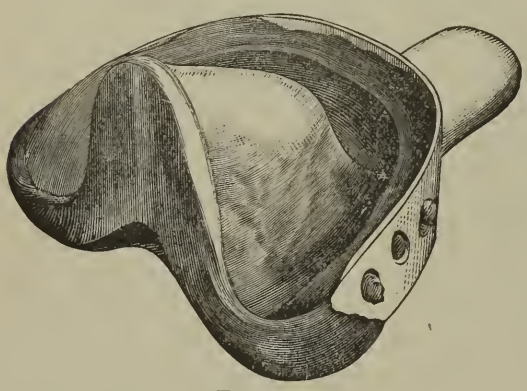
When either of these materials are softened, it is placed in the impression cup, which is warmed, to make it adhere to the cup. The cup is filled to the level of its rim. Too much material should not be used in the cup, as the excess is apt to curl or crowd over on to the soft palate, and produce nausea. Should the mouth have a high arch, the impression material, when put into the cup, may be pinched to an elevation, so as to be sure that this part of the palatine arch is well reached by the impression material.

The material being put into the cup, it is carried into the mouth. The operating chair should be a little lowered, so that the operator may stand behind, over and to the right of the patient. The cup is introduced into the mouth holding it by the handle, introducing it sidewise, and forcing out the cheek with it so as to pass in the other side with facility, without too much stretching the orifice of the mouth. It is then brought into position over the gum, when it is seized with the thumbs and fingers of both hands, on each side, and the material pressed steadily up against the gum, the head of the patient resting against the chest of the operator while he stands at the back of the chair, the back part of the cup near the boundry of the hard palate being pressed against this part of the gum *first*. The cup is now to be held fimly in position with the fingers of the left hand, *not permitting it to move from its place*, while with the forefinger of the right hand, insinuated into the mouth under the lips, the material is pressed against the buccal and labial borders of the alveolar ridge, covered by the gum. This being done the cup is held immovably in place until the material hardens, so that it may not be bent or twisted out of shape in taking it out of the mouth. The chilling of the impression material may be hastened by throwing a jet of cold or iced water all over the impression cup while in the patient's mouth, by means of a dental syringe. It is thought that a good impression of any material will adhere to the gum when the mouth is edentulous, and will require some force to remove it. Should it adhere too tightly, it may be loosened by holding the lips away from it, so as to admit air between it and the gum, or by throwing a jet of water between the lips and the impression,

when it will either fall from its position or be easily removed. Should it not do so, a slight cough on the part of the patient will usually effect its separation from the gum.

Of all the materials for taking impressions of the mouth, it is now almost universally conceded that plaster of Paris is the most reliable. To take an impression with this material, plaster of Paris is prepared and sold at the dental depots as "Impression Plaster." It differs only from "Model Plaster," in being prepared to set rapidly, so that the disagreeable operation of an impression taken with plaster is reduced to the shortest space of time possible. Many operators use model plaster, to which a little common table salt is added, for the purpose of inducing rapid setting. But this is not as good as the impression plaster, as the model plaster gets extremely hard, and in the effort to remove such an impression from the model, this is often marred or bruised—especially in partial impressions—in cutting away the impression from the model. A cup for a plaster impression should have its posterior edge turned upwards towards the soft palate, to prevent, as much as possible, the plaster from flowing over on to the fauces, and thus to rob the operation of some of its disagreements. (See Fig. 135.) This part of the cup, however, may be improvised by sticking to it, at this part, a piece of base wax, and bending this upward, to prevent the escape of the plaster. The cup being filled up to the rim with plaster which had been evenly mixed, and made smooth with the spatula, it is introduced into the mouth quickly, one side at a time, (pushing out the cheek on one side, the better to introduce the entire cup, when the orifice of the mouth is small), and when in the mouth it is brought to the center, the handle of the cup being held between the forefinger and thumb of the right hand, the other fingers resting against the palatine portion of the cup. It is then pressed upwards, the back part of the plaster in the cup being brought in contact with this part of the gum first, the better to drive out any air that may be near the arch of the palate, and afterwards on the forward parts of the gums. Should the plaster incline to set quickly, before the cup is brought into position, the fingers of the left hand may be quickly brought to the palatine surface of the cup to hold it steady, while the forefingers of the right hand may be used to press or mat the plaster against the buccal and labial surfaces of the gums. The plaster in the impression cup is held steadily and immovably in position until it sets hard enough to break with a sharp, clean fracture. This is determined by what remains in the bowl, where it had been mixed with water before being put into the impression cup. To be a good impression, it should adhere to the gum with some force. If it adheres too firmly it may be loosened by holding back the lips and throwing a jet of water from a dental syringe between the impression and the gums so as to loosen it. If the arch should be *moderately* high—too high for the impression cup to touch—it is a good

plan to daub all over the palatine surface of the gum some of the plaster from the bowl, with the spatula, and *then* introduce the cup, and take the impression as described. But if the arch is *very high*, it is best first to take an impression with modeling compound, and when hard to remove it from the mouth and chill thoroughly. Then dress off all superfluous material, cutting away about one-eigth of an inch from the inner surface of this impression on all surfaces where it is thought the plate will rest. A small quantity of plaster is now mixed and put into the space thus carved out, when it is re-introduced into the mouth, and pressed into place as before described.



[FIG. 134.]

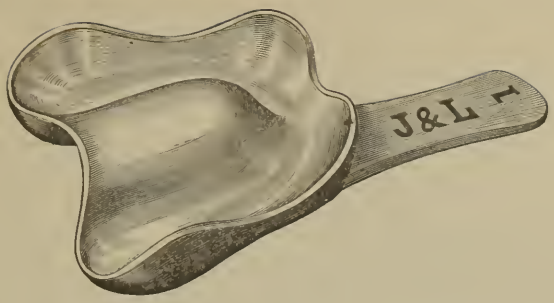
Fig. 134 represents the modeling compound impression prepared as has been described for cases where there is a high arch. Many operators contend that this plan is much the best for taking plaster impressions, whether the arch be high or low, and that much of the disagreements of plaster impressions (in edentuluos mouths) is overcome by first taking the impression in wax or modeling compound, and into this placing a small quantity of plaster, for the purpose of securing the accurate results which only plaster can give.

NAUSEA.

There are some persons so sensitive about the mouth, that they cannot bear any thing to touch the gums or tongue, and others that the slightest approach to, or encroachment on, the soft palate, produces a nausea and retching that is painful in the extreme. Such mouths have to be educated, as it is said, before an impression can be taken

There is, apparently, something excessively nauseating to such persons when plaster of Paris is used for taking the impression. Some of these seem to be able to put up with a wax or modeling compound impression, but plaster of Paris gags them beyond endurance. It is said that even for such as these, this idiosyncrasy may be entirely overcome by painting the mucus membranes of the mouth, and particulary that about the posterior edge of the hard palate, and the anterior edge of the soft, with a 4 per cent. solution of hydrochlorate of cocaine on a camel-hair pencil

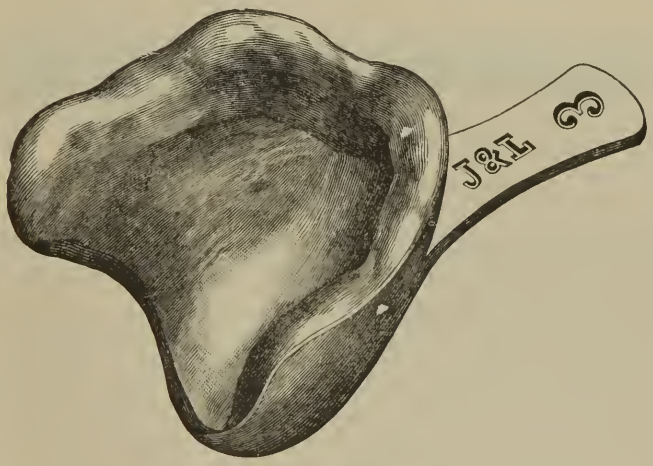
An impression cup, such as is illustrated by Fig. 135, would be the



[Fig. 135.]

proper form to take an impression of a mouth, such as is illustrated at Fig. 133. For larger mouths larger cups will be necessary.

The impression of the mouth taken with plaster of Paris is represented by Fig. 136.



[Fig. 136.]

THE MODEL.

The impression being secured, the next step will be the construction of the model. For this purpose the plaster impression is painted all over its surface with a *thin* coat of *shellac varnish*. When this has dried, another coat of *thin sandarac varnish* is applied to the same surface. This leaves the impression with a very smooth gloss, which is imparted to the model. Many operators object to the application of any varnish or oil to the impression, and fill it without any of these intermediary substances; but we have not found that the very thin film of these varnishes ever made any appreciable difference in the fit of a plate. Besides, with this preparation, the impression is parted from the model with much greater facility. There is no need to use oil or any parting compound on a plaster impression thus prepared, by simply placing it in a bowl of clean water,

to let it soak, while the plaster is being mixed for the model, there need be no fear of the two adhering,

To make a model from an impression taken and prepared as described, a sufficient quantity of water is put into a bowl, and fine model plaster of Paris is *sifted* into it. It is a bad plan to take the requisite quantity of plaster in the bowl *first and add the water to it.* Such a procedure is almost sure to result in a model filled with air holes. While the plaster is evenly mixed and freed from all air bubbles by putting it to the water, the impression is removed from the bowl of water into which it had been put; it is then inverted and shaken, so as to remove all the water that may have adhered to it. The bowl containing for the model plaster should be rapped on a table to disengage any air that might still remain in the plaster. The impression may be held by handle of the cup, with the left hand, while the plaster is conveyed into it with a teaspoon or spatula (Fig. 137) in the right hand.

[Fig. 137.]

THE SPATULA.

The impression is filled by conveying the plaster first on one side of the impression, and tilting the cup, so that the plaster will gradually and evenly flow all over the surface. This is made further necessary to prevent any air bubbles from getting in the model, should the impression be filled from different points. When the whole surface of the impression is thus filled, it may be laid on a table or work shelf, on a piece of paper, and gradually built up to the desired height or thickness by the addition of plaster, conveyed, little by little, with the spoon or spatula. For vulcanite work it is not necessary to build the model very high; a half inch above the highest point of the palatine arch is amply sufficient. A very good way to fill an impression is to take a strip of paper two inches wide by twelve inches, or more, long, and wrap this closely around the impression in the cup, holding it with the fingers or retaining the paper by gumming it with adhesive wax, and into the receptacle thus formed, conveying the model plaster with the spoon, until the model is of the proper thickness for the work on hand. When the plaster sets moderately, the paper may be unwound, leaving the model neatly made, and requiring but little after trimming. The model being thus made, and the plaster set hard, it may generally be removed from the impression (in edentulous mouths) by striking the cup, or striking the model a few raps with a horn hammer or wooden mallet. If this should fail to part the two, it will be necessary to cut away the impression piece-meal, so as to remove

it from the model. This must be done carefully, so as to avoid defacing the model.

[Fig 138.]

Some operators use a coloring material with their impression plaster, so as to form a line of demarcation between the two. Although this is a safer plan, it is not absolutely necessary, as the varnish used for painting the impression sinks into this and serves as a guide in the removal of the one from the other. To remove a model from a wax impression, it is simply necessary to place all in a bowl of hot water of 130° Fahrenheit to soften the wax, when the two are easily parted. For modeling compound the water is used hotter.

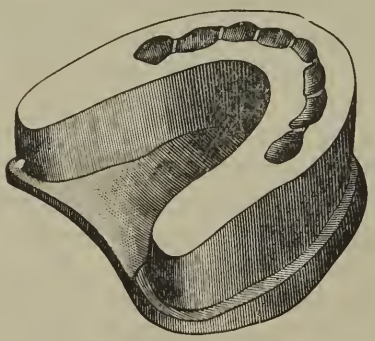
The model being removed from the impression, a base plate is moulded on it by softening a half sheet of base plate wax, and pressing or moulding this with the fingers all over the face of the model. It is then cut to the proper size with a heated wax knife, (Fig. 138.)

And a rim of articulating wax laid on, and secured to the base plate, running from heel to heel, as represented by Fig. 139 Some operators—and these the most careful—swedge up a plate for each case, whether for vulcanite or for metal work, by making dies and counter dies for the purpose. For vulcanite work, they use a plate of pure tin, which is easily swedged. In this way, although it may give more trouble, they are sure of a fit before the whole of the work is completed, which is not the case, when this is not done. The base plate being made by either mode, is prepared with the articulating wax, as has been described, and is then placed in the patient's mouth to obtain what is termed

THE BITE.

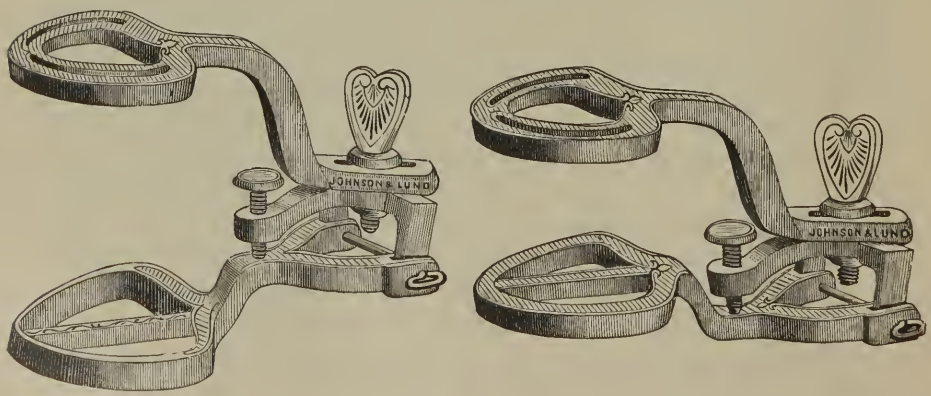
When the base plate, with the articulating wax attached to it is placed in the patient's mouth, she should be directed to close the lower teeth *gently* against it. The lips should be brought over this wax nicely, and a close scrutiny made of the features. Should this articulating wax be found too full, so as to puff out or protrude the lips, it should be marked where the fullness exists, removed from the mouth, laid on the model and cut away with a warmed wax spatula, sufficiently so as to reduce the fullness. On the other hand, should it be found that the features are not fully restored to their proper contour, it should be marked where fullness is required, removed from the mouth, laid on the model, dried thoroughly of the saliva adhering to it, and more wax added at the point requiring the fullness. This articulating wax should likewise be cut to the proper

length, so as not only to be a guide for the proper *fullness* but also for the proper *length* of the teeth that are to be supplied. For this purpose the patient should be engaged in conversation, made to talk, laugh, or smile, so that the operator may observe the length of the articulating wax, and either add to or cut away from it until it is of the proper length. This being all determined, the patient is directed to bite *slightly* into the articulating wax, only so much as to leave a slight indentation of the lower teeth into it. At Fig. 139 are seen the indentations left in the wax by the lower teeth. The median line is now marked on the articulating wax, and the base plate removed and laid on the model Some wax is then softened and put into a *lower impression cup, and an impression taken of the lower teeth.* From this a model is made. When this sets hard, it is immersed in a bowl of warm water to soften the wax, and the model of the lower teeth removed from the wax impression. The teeth of this lower model are now put into the indentations left in the articulating wax, which it exactly fits.



[Fig. 139.]

Some operators will not go to the trouble of taking this impression of the lower teeth, but it is by far the best and most intelligent way of working. The bite thus obtained is now fastened to the articulator (Fig. 140.)



Figs. 140.

THE ARTICULATOR.

A word may be said in reference to this articulator. By inverting the upper part it will accommodate both thick or thin models, which is quite an advantage, as when thick models are used, as in gold or silver plate work.

CHAPTER XI.

When the models are to be fastened to the articulator, the pin which serves as a pivot to hold the two parts of the articulator is removed. The base plate is removed from the upper model, and this, as well as the lower model, is placed in a bowl of water. The upper part of the articulator is now laid on a slab of glass or on a piece of paper on a table, and some plaster is mixed with water and a little salt. This is now put, with a spoon or spatula, on that part of the articulator designed to hold the upper model, and the upper model is removed from the water and placed in proper line and position into this plaster, When this has set, so as to hold the model to this part of the articulator, the wax base plate is put on the model; more plaster is mixed with salt and water as before, and the lower model is placed in position on the articulating wax The pin is now inserted so as to connect the two parts of the articulator together, and the lower model is fastened to the lower part of the articulator with the plaster mixed for this purpose. The reason why salt is advised to be used with the water when mixing the plaster to secure the models to the articulator, is because the plaster does not get so very hard with it as when it is not used, and thus the labor of cutting the model from the articulator when the case is ready to be flasked is considerably reduced. Before closing this subject o "the bite" we will enter a word of caution and protest of a manner of conducting this operation by some operators. Some will not go to the trouble of making a lower model as has been described, but will rely on the slight indentation left by the lower teeth on the articulating wax, which, as a guide in arranging the teeth for the upper denture, is almost useless; others will take a lump of wax and bend it, while soft, in the form of a horse shoe, introduce this in the mouth and the patient directed to bite into it. This is a most careless, unreliable, and unsatisfactory method of taking "the bite."

In the manipulations we have thus far described the idea has been to teach how an upper denture is to be constructed, when the base is to be of vulcanite or celluloid, the manipulations for the latter being the same in all particulars up to the time of flasking.

We have now learned how to take an impression in wax, modelling composition and plaster of Paris; how to make the model, how to take the bite, and how to secure the models in the articulator. Our next effort will be to describe the

MOUNTING OF THE TEETH.

The color, size and shape of the teeth having been decided on and selected, preparations are now made to attach these to the base plate. Before this is begun, however, it is well to secure the air-chamber in position on the model, as well as to lift or raise the hard parts on the model, so that when the plate is vulcanized it will not press on these, which are unyielding. It has been suggested and advised that, on taking a plaster impression, these parts be examined, and that the *hard places* in the mouth be traced, as nearly as possible, with a lead pencil, correspondingly *in the impression*, and before the model is made that these places, thus lined out, be scraped or cut away, so that when the model is made this scraping will lift or raise the plate that is moulded on the model, so as not to bring too great pressure at these unyielding points. In like manner, when the model is made, this is to be scraped or cut at the *soft places*, so as to induce pressure of the plate at these points. While there is reason in these suggestions, we fear that there is no certainty in these scraping operations, as we cannot tell for certain how much or how little we have scraped from impression and model. We will suggest a plan which will effect the same object with more certainty. The depots all sell thick tinfoil, which comes in long rolls and may be purchased by the ounce or pound at a nominal cost. It has been our practice to make a fold of one, two or four thicknesses of this (according to the hardness or rigidity of the spot on the gum), and mould it nicely and evenly on the model, and with a pair of small scissors cut out to pattern this fold of tinfoil according to the shape traced in lead pencil on the model. When this is done it is pinned down to the model with the heads of (small) ladies' dressing pins, so as to keep it in place. We do not meddle with the soft places, but simply raise the hard places as described. This being done, the central air-chamber is next made. For this purpose we take a piece of stiff brown paper and fold it on itself, and then trace on one side

FIG. 141.

FIG. 142.

half the shape of the proposed air-chamber. Fig. 141 illustrates this. The pattern thus traced is cut out with a pair of scissors, which will be perfectly symmetrical, Fig. 142.

FIG. 143.

The advantage of this is that any shape desirable for the air-chamber may be given. The pattern of the air-chamber being thus secured, it is laid on a piece of pure tin plate, about No. 18 thickness of the plate, and wire gauge, Fig. 143, and its shape traced with the sharp points of an instrument It is then cut out with scissors, and three holes punched through it with the plate punch, (Fig. 144).

FIG. 144.

It is laid on the palatine surface of the model in the position it is to occupy, when the three holes are countersunk with a round bur about the size of No. 6 (Fig. 145).

The chamber pattern thus prepared is shown at Fig. 146.

The chamber pattern is now secured to the model with the heads of small pins. This being done, a groove is cut all around the chamber pattern with a small instrument scratching into the model to the depth of the thirty-second of an inch. In forming the air-chamber it is better that this should be *large and shallow* than *small and deep*. Fig. 147 represents the model thus prepared.

These preliminaries being completed, we replace the base plate by softening it slightly, so that it will go over the air-chamber which has been added to the model.


FIG 145.

If gum sections or block teeth are to be used, they are fitted to the base plate by dressing away a portion of the articulating wax until they antagonize properly with the lower teeth The sides of the blocks should be ground and fitted to each other with great accuracy and nicety, so that the eye may not be able to detect the joint, in order to prevent the vulcanite from oozing through, and thus making an unsightly division between the blocks. This is done with a grindstone, as illustrated at Fig. 148, on the polishing lathe. The upper teeth should overlap the lower

slightly, but should there be a protrusion of the lower jaw they may be mounted so as to be brought together, edge to edge. The bicuspid blocks should stand slightly inward, and the cusps of these, particularly the outer or buccal cusps, should be ground down so as to accommodate the lateral motion of the jaws.

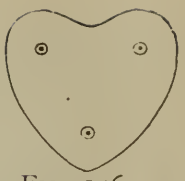


Fig 146.

In arranging the teeth on the base plate, the six upper front teeth should not be permitted to strike or touch the six lower front teeth, but should be kept apart about the thickness of cardboard. The bicuspids and molars only should be permitted to strike against the lower teeth. All the teeth being affixed to the plate, they should be tried in the mouth to see if they articulate properly, if the general expression is pleasing and natural, if the teeth are long enough or too short, if they show too much or too little, if the lips sink or are puffed or full. All these corrections being made, the case is replaced on the model in the articulator, and it is waxed up. This waxing is facilitated with the wax knife or spatula (Fig. 138). A rim of wax is put around the front and above the edges of the blocks. This rim should be slightly in excess of what it is intended to be, to allow for

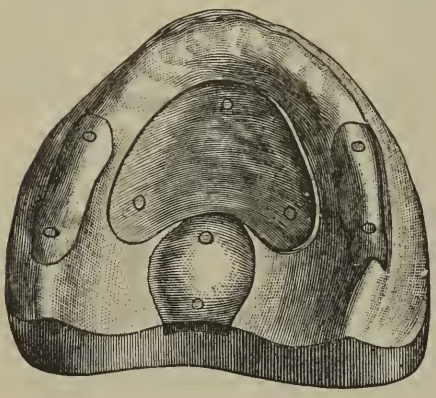


Fig. 147.

Model prepared with raised places of thick tinfoil at the hard points, and air-chamber secured in position.

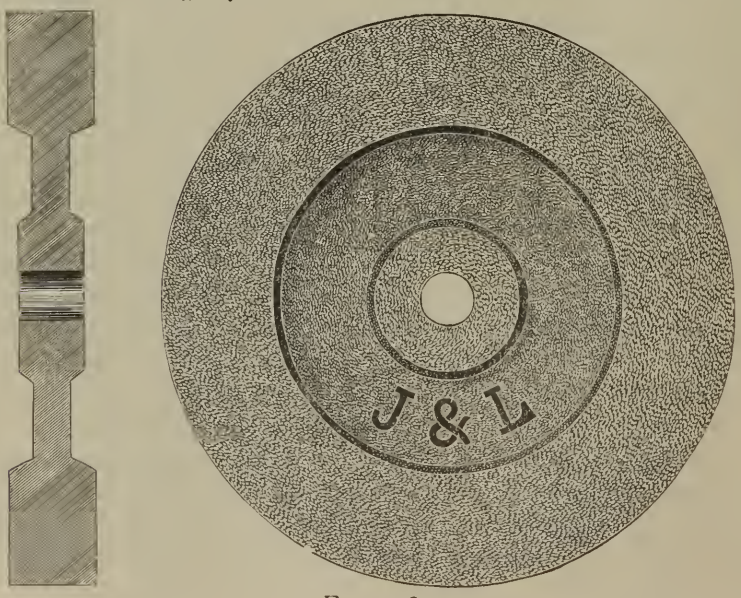


Fig. 148.

filing smooth and finishing . All superfluous wax from the inner or palatal surface is scraped off with the heated wax spatula, and all inequalities made even. The wax is make smooth by the means of short, quick and sudden blasts from a mouth blowpipe directed through the flame of a spirit lamp. This being accomplished, the model, with the teeth mounted in wax on it, is removed from the articulator. This is best done by placing all in a basin of water. The water partly softens the plaster, particularly that which was mixed with salt to attach the models to the articulator. It may then be cut away from the articulator and trimmed ready for flasking The teeth mounted in wax, as has been described, are shown in Fig. 149.

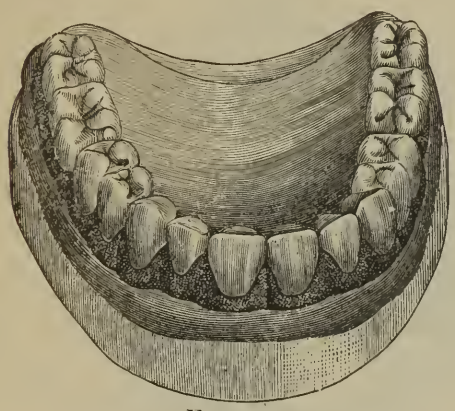


Fig. 149.

FLASKING.

This operation is accomplished as follows: Plaster is mixed in a bowl with water, and a part of it is conveyed with a spoon or spatula into the lower part of the flask (Fig. 150).

The model, which had been allowed to soak in water while the plaster was being prepared, is now pressed into this part of the flask until the plaster rises all round to the edge of the wax rim and along the back or posterior part of the wax plate. This is aided or better effected with the blade of a knife, so as to halve the case in this part of the flask. The plaster set, it is smoothly trimmed, and varnished with shellac varnish. The flasking of the case so far accomplished is represented in Fig 151.

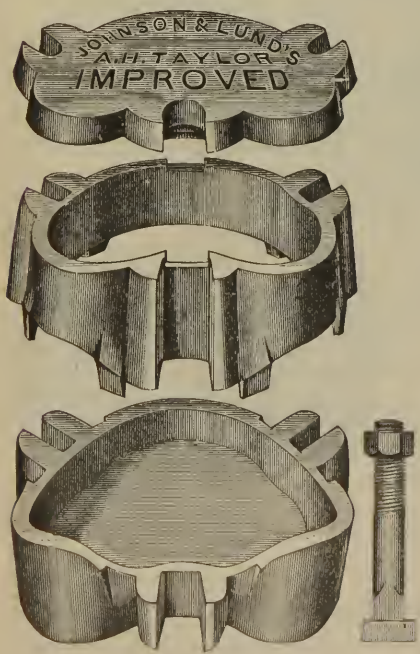


Fig. 150.

The varnished part of the plaster is now oiled, when it is placed in a bowl of water, while the plaster of the upper ring of the flask is mixed, and the ring is placed on the lower part of the flask. (See cut Fig. 150) containing the teeth. Plaster is again mixed, as before, with water, and the entire ring of the flask filled with it, and the cover is put on. When thus far advanced, the case has the appearance represented by Fig. 152.

The plaster in the flask being set

hard, the flask is warmed sufficiently to slightly soften the wax, when the two halves of the flask are separated—the wax and teeth adhering to the upper half—the model to the lower half. All of the wax is now removed from all parts of the flask and *saved* for the purpose which will be explained further on. Should any wax remain about the pins of the teeth, it may be cleaned away by pouring a stream of boiling water into the

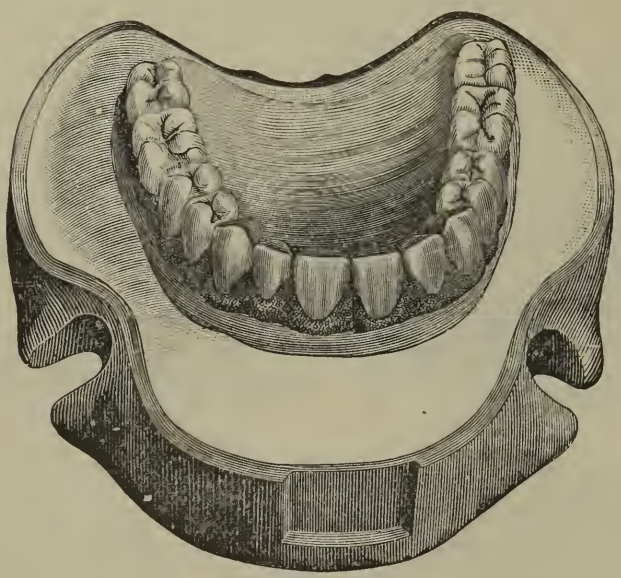


Fig. 151

flask from a kettle, at a slight elevation. This will melt and wash away all adhering particles. Gates or outlets are now cut in the plaster, in this half of the flask, which are intended to serve as vents for the egress of any superfluous rubber. The two halves of the flask is represented by Fig. 153, the one showing the teeth embedded in the plaster as well as the gates or outlets; the other showing model with the air-chamber and raised parts (done with folds of tinfoil, as previously described), embedded in the other The model in the lower part of the flask is now covered with a sheet of thin tinfoil, such as is used for filling teeth. The object of this is to prevent the plaster from adhering to the rubber during the process of vulcanizing. The case is now packed. In flasking a case where a gold or silver plate is used with rubber attachments, it is best to let the plaster cover a part of the wax on the palatal surface, rather than to let the plaster be just even with the

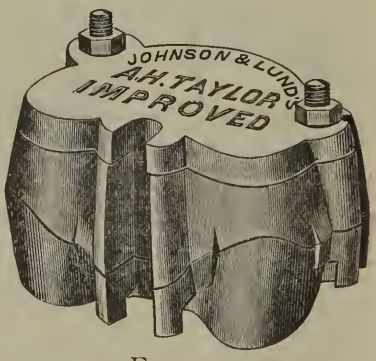


Fig. 152.

metal plate, for in this way the excess of rubber can be cut away without scratching or bruising the plate.

PACKING.

Before proceeding to pack the case, the joints on the inside near the pins, between the blocks, are nicely and carefully filled with some oxychloride of zinc cement, mixed quite thin and allowed to harden thoroughly. This is for the purpose of preventing the rubber from oozing through the joints and thus marring the beauty of the work. This may likewise be done on the outside, before the plaster is poured into the upper ring of the flask.

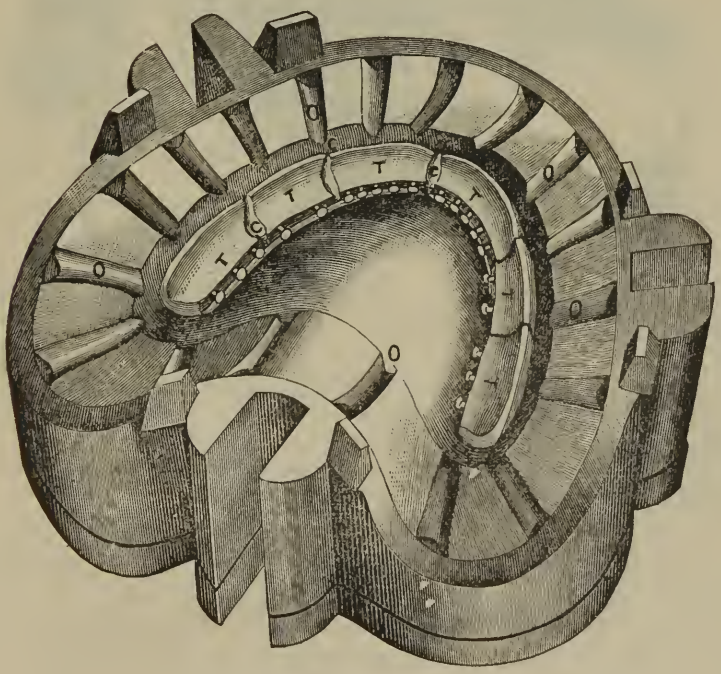


FIG. 153 (upper half).

T T T T T T represents the teeth, with the pins C C C are three of the joints filled with phosphate cement to prevent the rubber from oozing through. The other joints, on the right of the cut, are done in the same way.

O O O O. &c., are the vents or outlets to let the surplus quantity of rubber have a chance of escaping.

The wax which was saved from about the teeth, as well as the wax rim and wax base plate, are made into a ball and placed into a narrow, high tumbler. There are many thin glass tumblers of this kind sold in all glassware stores.

Water is poured into this tumbler until nearly full. A piece of thin paper is moistened with saliva and made to adhere to the outside, to the height of the water *when the wax is in the tumbler*.

The lump of wax is now withdrawn from the tumbler, when it will be found that the *water in the tumbler will have fallen.* There are tumblers of this kind fitted with a cover or top, in which there is a narrow, oblong tube, sold at the depots under the name of "The Rubber Gauge." It is

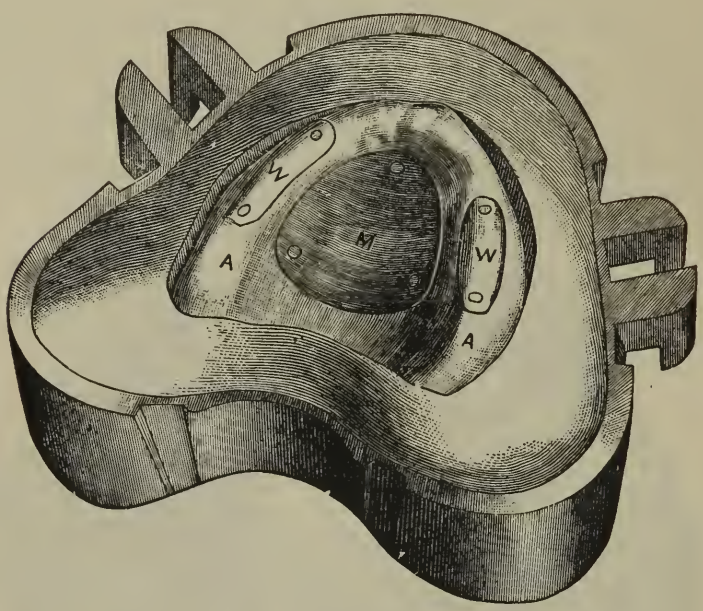


FIG. 153 (lower half).

A A, the model,
M, the air-chamber.
W W, folds of tinfoil pinned down to the model, on the hard part of the ridge, designed to lift the plate and relieve pressure.

better adapted for the purpose and more reliable than the arrangement described of sticking a piece of paper on the outside of the tumbler. The lump of wax being withdrawn and the water snbsiding in the tumbler, as described, rubber is cut up in small pieces, about the size of a dime or smaller, and thrown into the tumbler; this is continued until the water in the tumber rises to the same level as it did when the wax was in. A few pieces more of rubber may be added, to compensate for any unfilled space during the process of waxing, as well as to compensate for that which was washed away by the boiling water that adhered to the pins. The rubber is then removed from the tumbler and laid on a piece of clean cloth. This is laid over a pot of water which is kept boiling, by which the steam softens it when, when it is taken piece by piece and packed with suitable instruments into that part of the flask in which the teeth are embedded (Fig. 153, upper half). All of the rubber being packed into this part of the flask, the other part of the flask, which contains the model, is now placed in position and directed correctly by aid

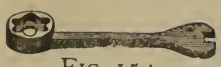


Fig. 154.

of the guide-pins with which the flask is provided. The case is now bolted together (but not tightly) and boiled. It is taken from the boiler from time to time and the nuts of the bolts tightened with a suitable wrench (Fig. 154), until the flask is entirely closed. An excellent device for this purpose is the "Flask Press and Boiler, invented by Dr. M. Lukens Long (Fig. 155).

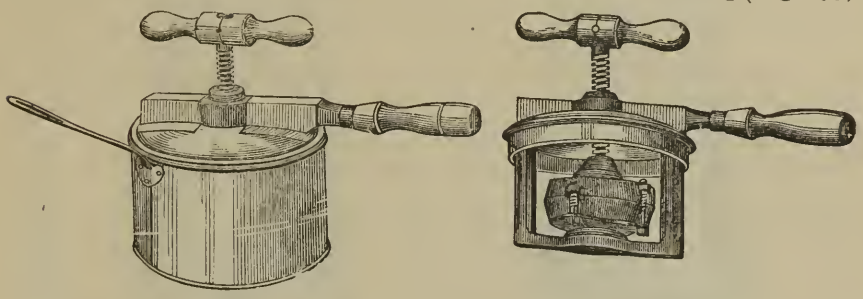


Fig. 155.

With this the rubber is softened thoroughly in the flask by the hot water in the boiler, while the press gradually forces the parts thoroughly and accurately together, not only saving the dirty work of handling the flask, but likewise the danger of breaking the blocks of teeth. There is another arrangement made for closing the flasks, termed the Flask Press (Fig. 156).

But while it does the work, it is not so handy or so tidy at the other to which we have alluded.

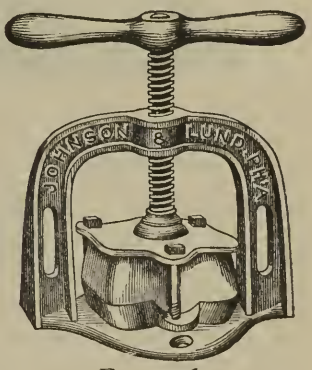
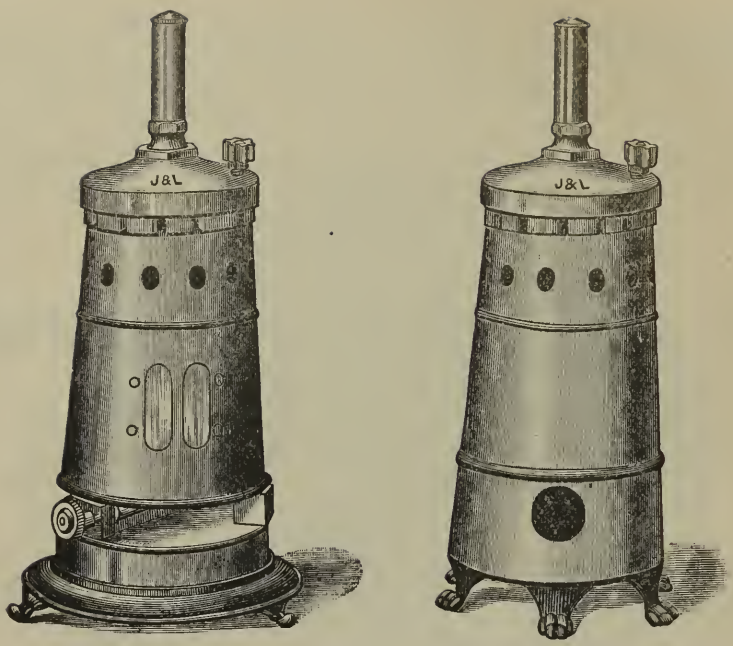


Fig. 156.

CHAPTER XII.

The case being now packed with rubber, is ready for the vulcanizing process This consists in changing the rubber from a soft to a hard substance, and is the discovery of Nelson Goodyear. He found that if pure rubber were mixed in certain proportions with sulphur and then subjected to a certain degree of heat in an air-tight vessel, the rubber was changed from a soft to a hard substance. The instrument used for this purpose is called a Vulcanizer, and is illustrated at Fig. 157.

In the illustrations set forth, one vulcanizer, letter A, is heated by means of a coal oil stove, the jacket or outer covering being set on the stove. The other, letter B, the heat is derived from illuminating gas—the jacket covering a Bunsen burner which furnishes the heat. This last is by far the best, where gas is available—being cleaner, more regular and more prompt in its working.



A. B.

FIG. 157.

Fig. 158 represents the pot and cover set into a bed-plate for the convenient use of screwing it down tightly. The pot consists of a very strong vessel made of sheet copper, brazed so as to withstand both heat and great steam pressure. At its mouth or orifice it is furnished with a strong screw-thread to which the top (which is made of brass and supplied with a thermometer to register the degree of heat) is secured. To vulcanize a case, the flask, which has been packed as described, is put into the pot, which is partly filled with water.

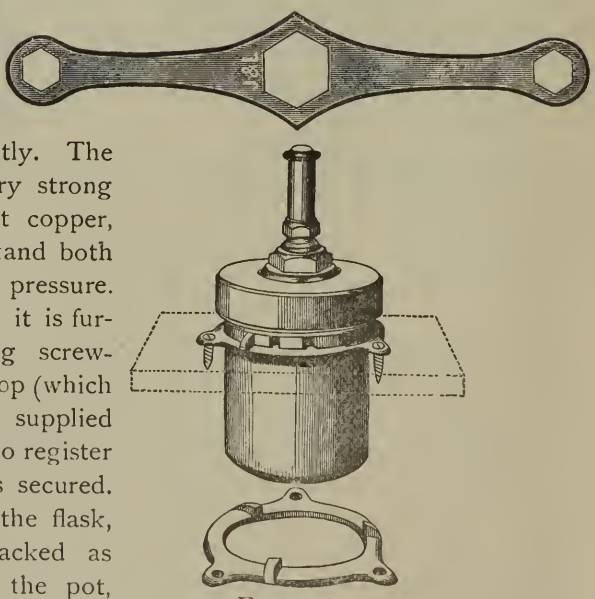


FIG. 158.

The top or cover, is then screwed down securely to the pot and set over the burner to be heated. The heat is permitted to continue until the mercury in the tube of the thermometer marks 320° on the scale. At this point it is kept from rising any higher by diminishing the heat, and

the temperature is kept at such a point that the mercury is retained at this point not being permitted to rise higher or fall lower than 320° for 55 or 60 minutes. After the expiration of this time the gas is shut off (if gas is used), or the burner extinguished (if coal oil is used), and the vulcanizer is permitted to cool down. If, however, the case be hurried it may be cooled down rapidly by lifting the pot out of the jacket and setting it in a basin of water to accelerate the cooling. When the mercury in the thermometer has fallen, by this cooling, so as to mark 200° of heat, the top may be unscrewed and the flask removed. The flask, however, should not be opened until *it is perfectly cold*, as well as the plaster investment within. This being accomplished, the nuts on the bolts of the flask may be unscrewed, and the plaster investment cut away, and the set of teeth cleaned of all adhering plaster, by meaus of stiff brushes used with water.

FIG 159

It has been observed that rubber, or vulcanite, as it is also called, is better cured or cooked if during the process of vulcanizing it is *kept out of water*. For this purpose it has been our practice to place in the bottom of the pot, the ring of an old flask, or indeed anything of the kind that will keep the flask, containing the work, *out of the water*. Only so much water (less than a half pint) should be put into the pot, as will barely come to the top of the ring placed in the bottom of the vulcanizer for this purpose, and on this ring the flask should be placed and the operation of vulcanizing proceeded with as has been described. For this reason we would recommend the purchase of what is known as a three case vulcanizer; for with one of this size two cases can be vulcanized at the same time, and both flasks kept out of the water by the means we have suggested. A very convenient device to have in the labaratory, to aid the memory is a "dumb clock." This may be made of a piece of card-board and figured like the face of a clock, with the two hands working independently of each other by being rivetted to the card-board. Its use will be as follows: Suppose the mercury in the thermometer of the vulcanizer has risen to the point of 320 degrees at *a quarter past nine o'clock*. You will then turn the hands on the dumb-clock so they will mark *a quarter past ten o'clock*, for at that time you will know that the heat is to be shut off. This is only suggested as a little convenience to aid the memory.

The case being removed from the flask and investment, as described, is filed into shape with what is known as vulcanite files. Fig. 159.

For cutting down the concave or palatine surface of the plate, the different forms of lathe burs represented at Fig. 160 will be found very convenient. As these, however, are injured or made

dull by contact, during their revolution on the lathe, with the porcelain teeth, the finishers represented at Fig. 161 will be found also very serviceable for this purpose.

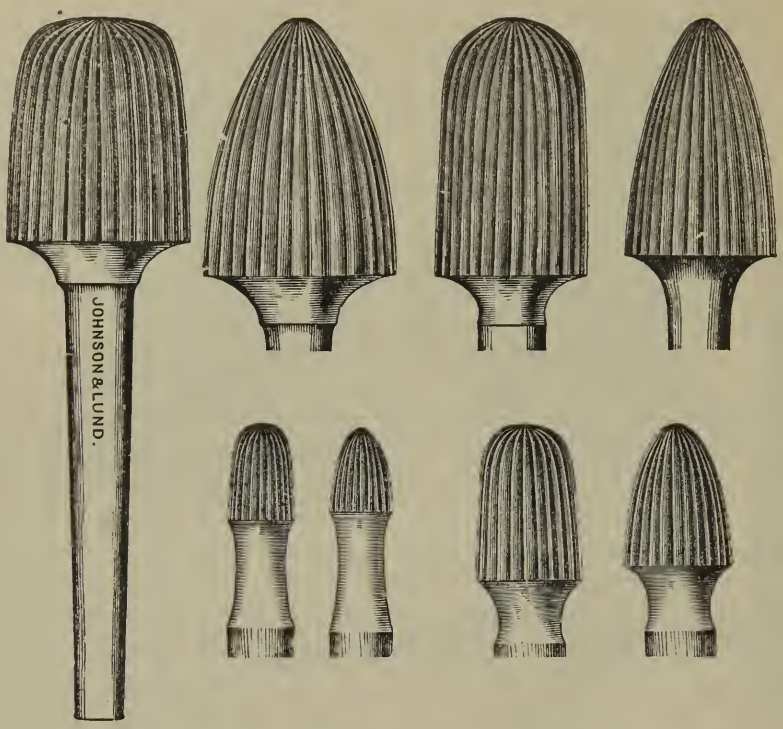


Fig. 160.

The forms three, four and six will be found the most useful. All the excessive roughness of the plate being partially reduced by

Fig. 161.

these appliances, it is further reduced in bulk or thickness by the use of vulcanite scrapers, Fig. 162.

3. 5.

FIG'S. 162.

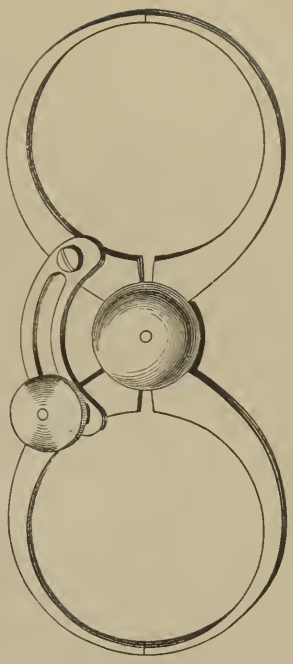


FIG. 163.

These two sizes and forms being the most useful, it is necessary to caution the operator during the progress of this reduction of the thickness of the plate, for fear it may be made too thin or that he cut through the plate into the air-chamber. For this purpose it is well that he provide himself with a pair of calipers, Fig. 163.

With this instrument, the thickness or thinness of the plate may always be determined The points of the instrument are opened and passed on the upper and under surfaces of the plate, and then pressed together. By examining the opposite points of the instrument, the thickness of the plate at any point is determined. The outer rim of the plate is reduced with the flat side of the vulcanite file, and all jagged edges of rubber which lie next to the porcelain facing representing the gum, be cut clean and smooth with an enamel chisel, such as is used for operating on the teeth, Fig. 164.

FIG. 164.

FIG. 165.

The two instruments (Fig. 165) will be found very serviceable for cut-

ting away the rubber that adheres to the teeth on the palatal surface of the plate.

The plate having been filed into shape and reduced in thickness with the lathe-burs and scrapers, it is made smooth of all file marks with sand-paper. When this is done it is rendered still smoother by the use of cork or felt wheels, used with finely powdered pumice stone and water, driven or revolved on the polishing lathe. When every scratch or blemish is thus removed, whiting mixed with water is used on the plate, to obtain the final polish. This is used with the wheel-brush on the polishing lathe ; Fig. 166, made of fine soft bristles, is the best size for the purpose.

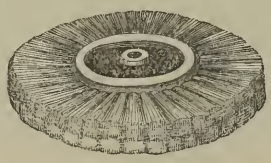


Fig. 166.

It is known as No. 18, soft bristles, 3 rows and 2 inches in diameter. In using the brush-wheel for polishing, the lathe should be revolved at a high rate of speed. A suggestion has been recently made in one of the English journals relative to the final polishing of rubber plates, for which we can vouch as to its efficacy. After the plate has been made perfectly smooth and free of all scratches by the cork or felt-wheels and powdered pumice stone, it is scrubbed perfectly clean with a brush, soap and water, and then dried. A drop or two of oil (no more) is placed on the palatial surface of the plate, the plate being held in the left hand. A teaspoonful of fine, dry plaster-of-Paris is now put over the oil, and this is rubbed with the tumb of the right hand for a minute or two. The rim is treated in the same way, only that the forefinger of the right hand is used as the polishing implement. A beautiful polish may be obtained in this way. The case is again washed with soap and water, with a soft brush like that represented by Fig. 167.

Fig. 167.

We have thus advanced in our instruction in vulanite work from the taking of the impression to the final completion of the case.

This instruction has been simply for an upper set. We propose now to go over the ground of how an entire set—upper and lower—is constructed. But as the manipulation of making the model, grinding and mounting the teeth on wax—waxing the case—flasking, packing, vulcanizing and finishing, for the lower jaw, being precisely the same as what

has been described for the upper jaw, it will not be necessary to repeat these processes.

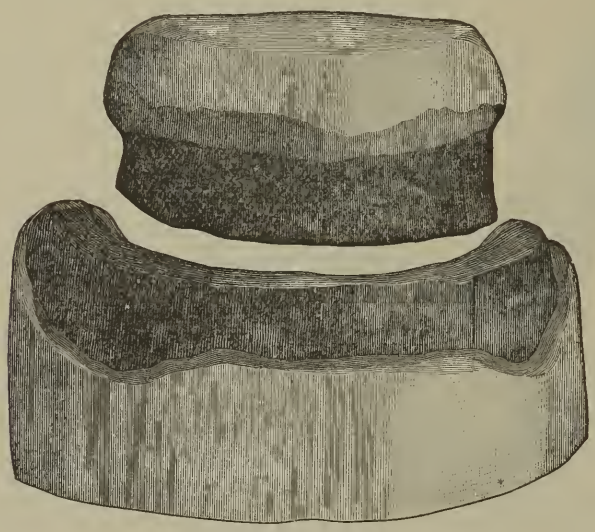
TAKING AN IMPRESSION OF THE LOWER JAW.

[FIG. 168.]

To take an impression of the lower jaw, where no teeth remain, an impression-cup such as is shown at Fig. 168, will be necessary, the same being of proper size. Impression plaster is placed into the cup and this is carried into the mouth, the operator holding the cup by the handle and standing to the right and slightly in front of the patient. When the cup and plaster in it, is brought to its position over the ridge of the jaw, before settling it down on the gums, the patient is directed to raise the point of the tongue to the roof of the mouth. This is made necessary in order to obtain an impression of the gums which lie far back in the mouth towards the throat, and which is often obliterated or rendered imperfect by the mass of integuments about the root of the tongue Indeed this part of the gum of the lower jaw is frequently difficult to take, especially for old persons, where there is an excessive absorption of these parts. The cup has frequently to be bent or altered in shape at these points, and even this at times fails to afford a remedy. The most successful plan we have found for such cases is to fill the cup with modeling composition and when this is pressed on the gum, the cup is held down with one hand, and, before the material gets hard we introduce the finger into the mouth and press the material against the gum at these points. The material thus manipulated is kept in place until it is hard enough to remove from the mouth without bending. It is then immersed in cold water until it is quite hard. When hard it is cut and trimmed with a pen-knife, to its smallest dimensions, so as not to interfere with its re-introduction into the mouth. It is then dug out to the depth of an eighth of an inch, in the same way as was done for the case of a high arch, as illustrated at Fig. 134, on the inner or concave surface, in the places all over the ridge where the plate is to rest, and this is scored or undercut to prevent the plaster from leaving it when it is withdrawn from the mouth. Impression plaster is then mixed and placed into this prepared receptacle. The cup is again put into the mouth and settled into its position over the gums. When the plaster hardens it is removed from the mouth and the model made as has already been described.

The models being made for both jaws, for an entire denture, base plates are moulded on them, as already described. The base plate for the lower jaw being so very narrow and without strength, (when made of base plate

wax) should be strengthened by bending a piece of iron wire in the shape of a horse-shoe, (or approximate to the shape of the case in hand), heating this, and while hot laying it on the wax base plate, in which it imbeds itself from its temperature; this will materially strengthen it. Articulating wax is now placed on both upper and lower base plates and trimmed into shape. Fig. 169.



[Fig. 169.]

represents the articulating wax placed on the base plates as has been described.

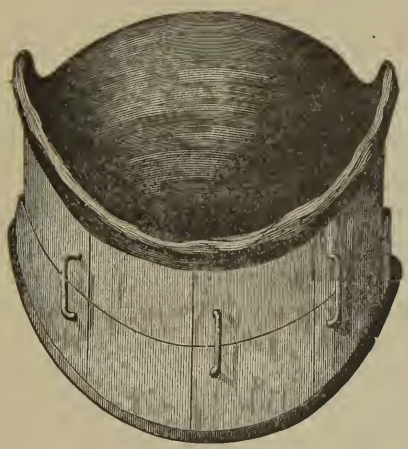
TAKING THE BITE FOR AN ENTIRE DENTURE.

The base plates with the articulating wax on them being thus prepared, they are placed in the patient's mouth and settled into place. The patient is directed to close the jaws on the wax, having moistened the masticating surfaces of the same with the tongue to prevent them from adhering. The lips are then drawn back and the articulating surfaces of the wax examined where they touch, and are marked. The plates are removed from the mouth and these points are cut away. They are again inserted in the mouth and the same examination and marking made and corrected as before. This is repeated until the *masticating surfaces of the wax touch evenly all around.* The wax is also to be dressed off or added to, to restore all fullness or depressions. These being all accomplished, three marks are made on the articulating wax running from the upper to the lower base plates. One mark at the median line and one on each side in the neighborhood of where the first or second bicusped tooth would be. This being done the patient is engaged in conversation and told to close the jaws, not too hard, on the articulating wax. After repeated trials in

this way, if the marks on the wax are found to come *always in the same place*, on the jaws being closed, it is fair to presume that the correct bite has been obtained. This being accomplished, three little pieces of iron wire are bent like staples. Fig. 170.

Fig. 170.

These are held, one at a time, between the points of the tweezers in the blaze of the spirit-lamps and when thus heated they are pushed into the upper and lower articulating wax, *one-half into each*, the lips being held out of the way to prevent being burnt. One of these little staples is placed at the median line, the other two at any point, on each side, in the neighborhood of where the bicusped teeth would be.



[Fig. 171.]

The upper and lower plates being thus fastened together the patient is directed to push the plates out of the mouth with the tongue. Fig. 171 represents the upper and lower plates thus united.

The upper and lower models are now put into their base plates, and these are secured into the articulator in the manner described for doing this when simply an upper denture was being made.

The mounting of the teeth for a lower case is precisely the same as the mounting for an upper. The articulating of the teeth, for an upper and lower denture requires more care and nicety of manipulation than when simply one or the other is under construction, but the operation is not attended with very great difficulty. We find it preferable, in entire cases, to mouut *the lower teeth first*, and then antogonize the other to them.

When the teeth are all mounted in wax, they are tried into the patient's mouth, and any alteration found necessary in the position of the teeth is corrected. The plates are then removed from the mouth, and waxed as before described. In packing the low case, *weighted rubber* is sometimes used to give greater stability, by weight, to this denture, which only depends, in many cases on its weight, or on the knack of the patient to keep it in place. Sometimes instead of weighted rubber the case is *loaded* by placing or imbedding in the rubber, small pieces of thick pure tin plate. This, however, is not so good as when weighted rubber is used, as frequently pieces of the thick tin plate crop out on the outside of the plate and make a blemish on the work. Sometimes it is so difficult for the patient to get accustomed to wear both the upper and lower set at the same time, that resort must be made to spiral springs to retain the

lower set in place. After a time, however, the patient gets accustomed to the plates and learns how to keep them in place without the aid of the spiral spring.

The tin foil which was put on the upper model, to prevent the rubber from adhering to the plaster, is removed by immersing the case in a solution of nitric acid and water, in the proportion of one part of acid to two of water. This leaves the plate perfectly clean and smooth.

CHAPTER XIII.

By far the most artistic piece of work may be constructed with plain teeth, using pink rubber to imitate the gums. By the use of plain teeth, the operator is not trammeled in the arrangement of the teeth as he is with gum section blocks; for he can protrude this tooth, or recede that; he may imitate an irregularity with this or leave out a tooth to disarm suspicion by the apparent loss of a tooth in that In a thousand ways can the vagaries of nature by imitated and present a denture which is as close an imitiation to nature (as far as the teeth go) as is possible. True it is that manufacturers have not yet been able to produce an article of pink rubber that is the exact imitation of the color of the natural gum tissue, yet experiments are strongly tending in this direction, and great improvements in color have been accomplished. On the other hand, if we consider how little of the gum shows in artificial sets, with the large majority of cases, this is no great drawback against its use. Another object gained in the employment of plain teeth with pink rubber gums, is the absence of the joints between the blocks. It requires exceedingly nice work to fit these joints so closely as to prevent the oozing of the rubber through them, even with the utmost precaution, and when this is not accomplished, and the patient shows the gum in laughing or talking, the case is known at once as being artificial, independently of the stiff "ear of corn" expression which block section teeth nearly always have.

One of the principal objections to the use of plain teeth with pink rubber gums lies in the liability of the red rubber cropping out on the front, and thus marring the finish of the work. Yet, with care, this can be avoided. We purpose to give instructions in the manner of packing such cases.

PACKING A CASE WITH PINK RUBBER GUMS.

The case being flasked with plain teeth, in the same manner as described for flasking with gum section teeth, and the flask parted and wax removed as before described, that part of the flask containing the teeth is set over a stove or in an oven to dry thoroughly. We know of no better

adjunct to the laboratory for general purposes than the Bunsen burner and basket.

It will be found admirable—where gas is available— for vulcanizing, for boiling water, for melting tin, or fusible alloy for dental plates, and also to heat the flask for packing a case with pink rubber. For this purpose the flask containing the teeth is placed on the basket, (over which a tin plate or round iron grating is put) and the plaster will be heated. The pink rubber is cut up into very small pieces, about the size of a duck shot, and put on a piece of paper or in a box cover. Other pieces about a quarter of an inch wide by a half-inch long are also cut up and placed separately. The flask being well heated the gas is extinguished, when a towel, pad, or old rag is placed on the flask to prevent it from burning the hands. Beginning on one side, the rubber is taken up one piece at a time on the point of a small thin excavator, while with the left hand another excavator, bent at nearly right angles, the teeth are held in place. The first piece of rubber is carried between the first and second molar and packed well into place; piece by piece is added to this, going from tooth to tooth all around, and covering all surfaces of the tooth except that from which the pins project, until all the spaces between the teeth are well filled. If the flask gets cold before the whole case is packed the gas should be again lighted and the flask reheated. It is very necessary that the flask be hot while packing with pink rubber. If this is neglected, little spaces will be left, and the red rubber used to pack the rest of the case, being so much softer than the pink, will find its way into these spaces and crop through on the outside, and make a blemish on the work. When the case has been packed as described, the larger pieces of pink rubber are placed on the above, and packed above the teeth so as to form the gum above the teeth. This should be well packed, against that previously used in small pieces, so as to leave no possible aperture through which the softer red rubber may creep. This being done with all care, the rest of the case is filled with red rubber as will be indicated by the case in hand. The flask is then closed but, in tightening up the bolts the flask should not be put in water and boiled so as to soften the rubber, but the softening of the rubber should be done with *dry heat*. If the flask, after having been heated to pack the pink rubber be put in hot water and boiled, the plaster investment will, in a great measure be *slacked*, and this, if it do not result in failure, might cause the teeth to change their places on account of the softness of the investment, or it may aid what we hoped to prevent, viz: the cropping through of the red rubber on to the pink. In pressing up a case packed with pink rubber, therefore, be sure to do this with *dry heat* and not by boiling the flask in water.

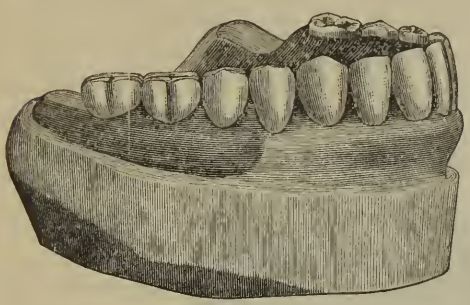
A very convenient thing to have in one's laboratory is a pad for handling hot flasks. It consists of two or three old towels put together one on

another so as to make a thickness of about a half or three-quarters of an inch, with a size of about ten inches square. This is tufted, so as to hold the old towels together, when the hole is covered with some kind of stout twill or bed tick. On one end a loop of tape may be sewed to hang it up by.

Before concluding our instructions on Vulcanite Work we will refer to cases that are frequently met with. We refer to cases where there is a considerable fullness or protrusion of the upper gum, which prevents the employment of either gum section blocks, or of plain teeth with pink rubber gums.

If either of these styles of work is used, the lips, already puffed from the fullness of the gum, will very evidently be more so, if any substance is laid over it, which wonld give the patient a very unnatural expression about the lips. But while this fullness exists in the front of the mouth, it is frequently found that the gums on each side, in the region between the second bicusped to the last molar, have fallen away, so as to make the cheeks fall in, which require to be filled out. The way to combat cases of this kind will be as follows: Plain teeth are used for all the case. The six or eight front teeth are ground to fit up against the *natural gum of the moael.* The bicusped and two molars may overhang the ridge slightly. A base plate for such a case should not extend over the alveolar ridge, either at the sides or in front, but should just come up to the ridge. To make a close joint between the teeth and the natural gums, the model may be carved out *slightly* where each tooth sets up against the gum. The yielding of the natural gum will accommodate itself for this carving on the model. It is best in such cases that the teeth be held down firmly against the model when flasking. This would be impracticable if the teeth were permitted to come away in the upper part of the flask. In order to combat this, we proceed as follows: The teeth being all grouud and fitted to the model and articulated, they are attached to the base plate from their *palatal aspects only*, permitting *no wax at all* to come forward on the buccal or labial surfaces. The base plate and teeth attached to it are now removed from the model The model is dried and when cooled, the teeth and base plate, which were removed in order to dry the model, are replaced and the model painted on each side, with a solution of rubber in chloroform, from the neighberhood of the first bicusped to the heel of the plate. Pink rubber is now cut in small pieces, softened on a hot brick, and applied to this space by means of a warmed wax spatula heated in the blaze of a spirit lamp. These parts (on each side) are built out to the necessary fullness. The wax base plate, over the palate surface, is smoothed and the case is then flasked. When separated, the wax is removed and this part of the case packed with red or black rubber (as preferred) as has already been described. It will be found that in packing the pink rubber on each side, as directed, it will

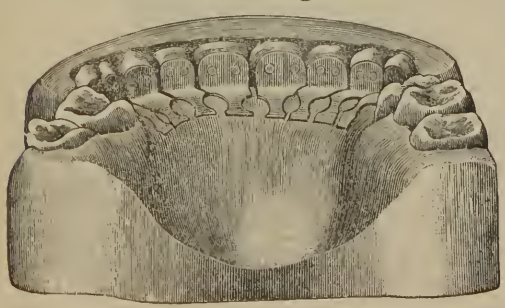
fail sometimes to lie close to the teeth and no amount of coaxing will avail to bring it close up. It will be no error to fill such minute spaces, or any rough uneven places with a little wax; for when pressure is exerted to close the flask, the wax will melt and sink into the plaster investment, and the rubber will fill all inequalities in the process of vulcanizing In using the wax spatula to pack the pink rubber, care must be scrupulously observed that the spatula be *entirely free from all trace of wax or grease.* If any wax adhere to the spatula, it will get on the pink rubber and it cannot be made to adhere to the rubber solution with which the model was painted at the sides. Fig. 172 will illustrate what has been described.



[Fig. 172.]

It represents a model of such a case. The six front teeth are ground to fit against the model, while the side teeth are packed as shown with pink rubber, *before flasking.*

There is still another class of cases where other means are to be employed. Such cases are what are termed "long bite." They are cases where the lower teeth impinge so close to the upper gum, that either a metal plate has to be used, or if not, the teeth are to be backed with gold and a heel or extension soldered to them, and this extension imbedded in the vulcanite. Plain teeth for metal work are ground to fit up against the model in the manner above described. This being done, four holes are countersunk on the model and the space varnished with shellac varnish. This being dried, it is oiled, and plaster of Paris, mixed with water to a thick paste, is poured over the faces of the teeth and into the countersunk holes. When this has hardened, it is divided at the center, and each half lifted off. The wax used to hold the teeth in position while grinding is then removed. The teeth are backed and the extensions bent and fitted. The extensions are then gummed to the backings with adhesive wax, removed from the plaster matrix, invested and soldered. This being done, they are boiled in pickle (sulphuric acid and water,) to remove the melted borax, filed up, replaced in the matrix, waxed up, flasked, packed and vulcanized. It is needless to say that only gold can be used for these backings and extensions, platinum being too soft. Fig. 173 will illustrate what has been described.



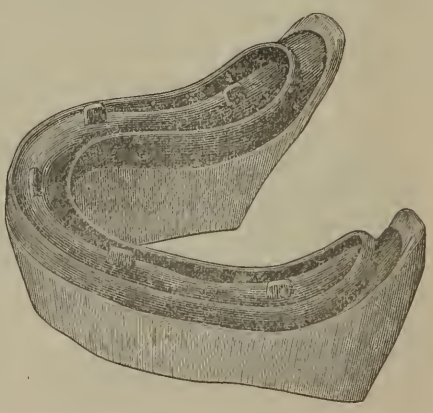
[Fig. 173]

In making use of pink rubber to imitate the gums, it is found to be quite laborious to polish this where it runs down in points between the teeth. Much of this labor may be saved by burnishing thick tin foil (No. 60) over the wax before the case is flasked. This must be done very neatly and smoothly, letting the foil run up nearly to the top of the wax, and then bending it out at right angles just above the rim so that the investment in the lower part of the flask will not touch it. The upper ring of the flask is now set in place (after the parts have been varnished with shellac varnish, and oiled) and the plaster of investment poured in. When the investment is hard, the wax is softened by placing the flask in warm water. It is separated and all adhering wax washed out with a stream of boiling water. (Not picked away.) The case is then packed with pink rubber as has been described. Fig. 174 will better explain what we have described, Cut, Fig. 185 shows the process more clearly.

[Fig. 174.]

Sometimes the lower jaw is so much absorbed that there is little to retain the plate in place. When such is the case they are frequently weighted, or weighted rubber is used in their construction. A more artistic and nicer case can be made by making a cast plate of Weston's, Reese's or Kingsley's metal and on this vulcanizing the teeth. For this purpose a wax plate is formed on the model as shown in Fig. 175.

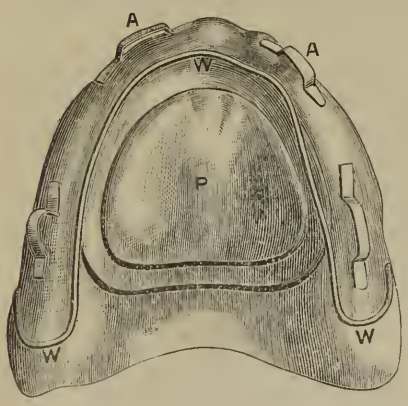
When this is done it is invested in a flask for this style of work and a plate of this kind cast. This being done, articulating wax is placed on it and the bite taken in the manner already described. The case is then placed in the articulator



[Fig. 175]

and proceeded with in the same way as described. The small pieces seen on the plate in the illustration are for the purpose of securing the rubber to the plate more firmly. Plain or gum section teeth may be used on this metal plate and when these are waxed up they are flasked, packed and vulcanized as before described.

A similar procedure to the above for the upper jaw, is what is known as a metal plate with vulcanite attachments. The plate is swedged and prepared as for all gold work. The teeth, either plain or gum sections, are ground and articulated. The wax which holds the teeth to the plate, is scraped away an the palatal surface, to its smallest dimensions, (consistent with strength) without exposing the pins of the teeth. The plate is then scratched where the wax joins it, to indicate where the rim is to be soldered. A plaster matrix is then made to hold the teeth in their position. The wax is then removed and a piece of wire is soldered to the plate, at the place where it was scratched, before the wax was removed The plaster matrix is then replaced and the teeth put in their respective places, and the most favorable places are marked on the plate for soldering on the attachments. This being done small pieces of plate bent like a staple are soldered to the plate as shown in Fig. 176.



[Fig. 176.]

P shows the plate; W the wire on its palatal surface; A the attachments.

The objects of the wire soldered on this part of the plate is merely for the purpose of making a finish to the work. In starting this wire for soldering, the plate is put on the die and the wire is bent so that it will lay close to the plate, beginning near its heel. It is then tacked with a small piece of solder, being held in position with a wire clamp such as is shown at Fig. 43. Once started, it is bent close to the plate and soldered, little by liitle, until it is all united to the plate.

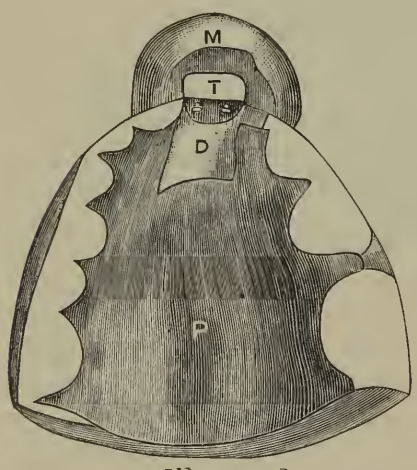
If the plate be made of *gold* or *platinum* this will be all that is necessary, but if the plate be made of *silver* it will be necessary to have it *heavily electro gilded*, otherwise it will not be possible to vulcanize rubber next to it, as rubber will not harden next the silver. It has been suggested *to tin* the surface, next where the vulanite is to rest, but this is attended with considerable labor, *as every particle of the silver must be covered with tin*, otherwise the vulcanite will not harden. It may be done in this way by making the *attachments of gold*, and then tin the other parts of the silver plate, next where the vulcanite is to rest. It is not a good plan to tin this part of the silver plate, and to tin the silver attachments and

solder these on to the plate with tin, or tinner's solder, because we have found that done in this way the fluids of the mouth seem to act on the tin, causing a disintegration, which finally end in the vulcanite falling off from the plate. *Heavy electro gilding*, on a silver plate with vulcanite attachments, seems, in our experience, the best way out of the difficulty.

REPAIRING VULCANITE WORK.

PUTTING A TOOTH ON A PLATE.

The first effort in the repair of vulcanite work is to pour plaster into the plate, so as to seeure, as it were, a model. If the tooth is merely loosened and almost ready to drop off, it is pressed into its proper position and thus secured with adhesive wax, and then to cast a plaster matrix over its labial surface, extending the same to the front part of the model. When set, this is lifted off, and should the pins in the tooth be perfect, and perfectly firm in the tooth, it will only be necessary to remove the plate from its plaster model, cut a *dove tail* out of the plate, wax up the case, put it in the flask, separate the parts of the flask, remove the wax, pack with rubber, vulcanize and finish. Fig. 177 represents such a case.



[Fig. 177]

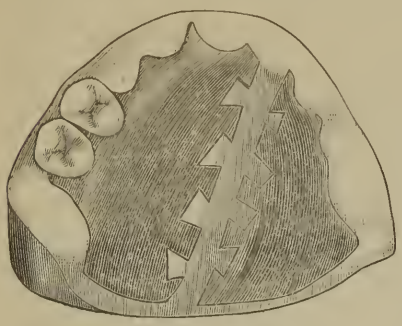
M the matrix, T the tooth, D the dove tail cut out of the plate; P the plate.

If the tooth be useless, that is, broken, or the pins destroyed, another tooth will have to be provided. One from the same mould should be obtained if possible, when it is ground and fitted, the plaster matrix serving to give the proper position. But if the tooth be lost, it will be necessary to take an impression so as to obtain the proper position. This impression should include one tooth on either side of the tooth that has to be replaced. In such a case it will not be necessary to make a plaster matrix, as the model thus made will give the proper direction to the tooth that is to be replaced.

Should the patient have lost one of his or her own teeth, and wish a tooth added to the plate he or she is wearing, an impression is taken as described, and the artificial tooth added to the plate in the same way as has been described above. When taking such an impression, it is well to let the plaster (or wax) extend *well on the plate* so that it may be secured thereto, in order that the model may be cast both on the plate as into the impression. Plaster in such cases is much more reliable, and is as easily taken as wax.

REPAIRING A CRACKED PLATE.

When such a case ofiers, the crack is put *in its exact position* and held there by dropping melted adhesive wax over the crack. It may be necessary to have some one do this while the parts of the plate are held together. The plate being thus secured to its original shape by this procedure, plaster is cast into it. When set the adhesive wax is scraped off and the parts of the plate lifted from the plaster model. The broken parts of the plate are then cut so that they may be ⅛ of an inch or more from each other when replaced on the model. Dove tails are then cut with a fine saw, on the plate, on each side of the crack. When it is waxed, flasked, packed, vulcanized and finished. Fig. 178 will explain what we have described.



[Fig. 178.]

TO REPLACE A BLOCK OR BLOCKS ON A PLATE.

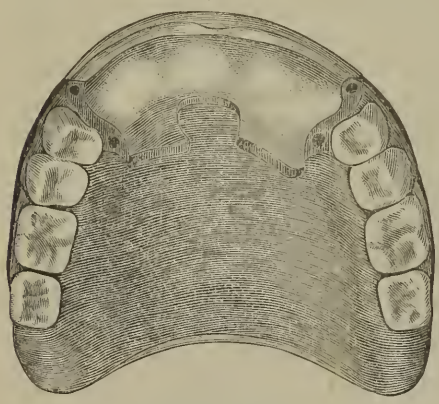
In this case, as in all others, plaster is first cast into the plate. If the teeth are merely chipped or broken, without the block or blocks being entirely off the plate, as is most frequently the case, the next procedure will be to cast plaster over the palatal surface of the plate, letting this extend over the grinding surfaces of the molar and bicuspid blocks as well as over the cutting edges of the broken front blocks. This is intended to serve as an articulating model by which to replace the broken blocks. The old broken block or blocks may be removed by passing the case to and fro through the blaze of a spirit lamp so as to heat the blocks sufficiently, that are to be removed so as to soften the rubber around the pins, when they may be readily pushed off the plate. The plate is then cut down well on the palatal surface, and also on its front part, next towards the rim, and two holes are drilled in the plate, one towards each bicusped block, as shown by Fig. 179.

[Fig. 179.]

Blocks of the same mould should be secured, if possible, and these are neatly jointed so as to make close joints both with the bicusped blocks as well as in front. The plaster articulator is laid on the plate, to determine how far in or out the new blocks are to be set, when the case is waxed and flasked.

When the flask is separated, the wax is all removed and packed with rubber, not omitting to fill the two small holes which were drilled in the plate next each of the bicuspid blocks.

If it is found impossible to obtain blocks that will lie close enough to the plate to make a neat job, the plate is removed from the model and the whole of the front part is sawed out, beginning at the rim and sawing dove tails on the palate portion, as shown by Fig. 180.



[Fig. 180.]

Two small holes are drilled, one on each side of the rim, and two on the palate surface next the bicuspid blocks. The blocks are then ground and jointed. The blocks are held in position by waxing them to the plate *on the palate surface only*. The two small holes that were drilled in the rim are filled with very small pieces of rubber, and that part of the model, on the front, between these holes, is painted with rubber solution. A strip of rubber is laid on the model, at the painted surface, to which it readily adheres, and a sufficient quantity more of rubber in small pieces, is added to this so as to form the new rim. This may be done with the heated wax knife, from which all adherent melted wax is wiped off. The rim is built out rather *in excess* of what it is to be, because it is more readily filed into shape when vulcanized. Any of the little places where it is found difficult to fill in with vulcanite, may be filled in with wax, as this readily melts and is absorbed into the plaster investment during the vulcanizing process, while the pressure of the bolts on the flask will force the vulcanite into these places. The case is then flasked, and separated, the wax removed from the palate surface and replaced with vulcanite; the flask closed, and the case vulcanized and finished.

TO PUT ON A GOLD CLASP.

There are some persons, so constituted, that they cannot have the roof of the mouth covered by a plate. These have to wear small plates made of gold, silver or vulcanite. It often happens that the teeth to which the plate is clasped decay away, from the rub-

[Fig. 181.]

bing of the clasp, and are then lost. Fig. 181 represents such a case.

The right bicuspid to which the plate was clasped, is no longer serviceable, and the plate will not hold in place. It must be clasped to the right cuspid tooth. A vulcanite clasp cannot be put on this tooth, as it would be too bulky, and also, it would show. A gold clasp must be supplied. The plate is kept in position, and a plaster impression is taken over the plate, and also including the cuspid that is to be clasped. A model is made by pouring plaster into this impression and over the plate. When set the impression is cut away leaving the model as shown by Fig. 181. The plate is removed from the model and a dove tail cut into it as shown. A clasp is bent and an extension soldered to it as shown by the supplemental cut in Fig. 181. The case is then waxed up, flasked, vulcanized and finished.

In making the extension to the clasp, this should be bent in a *wavy shape* so that the vulcanite will not only hold by the little on the end of it, but will also flow beneath and thus add strength to the clasp.

CELLULOID WORK.

The general manipulation for the construction of celluloid work is the same as that for vulcanite work. Although much was expected of this material it has not fulfilled the expectations of the profession. All conceded the beauty of the work, the ability to produce the most natural and life-like results, the close imitation to the color of the gum, compared with that of pink rubber, and of its more agreeable working attributes, compared with rubber; but its change of color when subjected to the fluids of the mouth, its frequent warpage, its soggy appearance when worn for a long time, brought it into disrepute. Dr. Frederick Seabury, however, (and some few others) held an abiding faith in the material, and he, after very many exhaustive experiments, and as many discomfitures, claims that if the material be moulded on metal dies, and protected on all its exposed surfaces by metal next the investment, so that there will be no after finishing, that a celluloid denture will neither warp, change color, or absorb the fluids of the mouth. In other words, the whole surface of the plate will present a *vitrified surface*, derived from its contact with the tin next the investment, which will effectually prevent these shortcomings, as well as the mode of moulding the material by his process, in a dry hot oven.

We propose to offer these directions as clearly and as succinctly as possible, of his process. An impression cup is selected suitable to the case in hand. This is filled with the necessary amount of *wax* and an impression of the mouth taken. All superfluous wax, which was forced beyond the edges of the cup is carefully trimmed away. About a *teaspoonful* of plaster is evenly mixed to the consistency of cream, and evenly spread over the surface of the wax impression, which is re-intro-

duced into the mouth, so as to take the impression with plaster; the wax being used as a vehicle for the plaster.

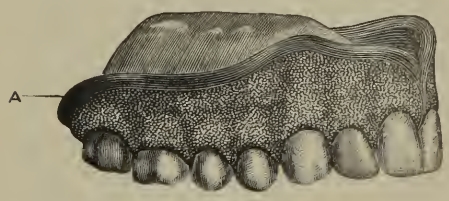
A model is made from such an impression, and a die (tin) from such a model. The model must be shaped so that it will draw easily from the moulding sand, and should there be any deep undercuts, cores should be made of these places, so as to obtain a perfect die. The model should be tried into the celluloid flask before making the tin die, so that it may be cut to its smallest dimensions, to enable the workman to put it well *back into the flask*, to permit the largest bulk of the investment plaster to flow on the front or labial surfaces of the teeth.

In making the die the metal should not cover the highest part of the palatine arch more than one-eighth of an inch. No central air-chamber is used.

The bite is taken the same as for vulcanite or other artificial work.

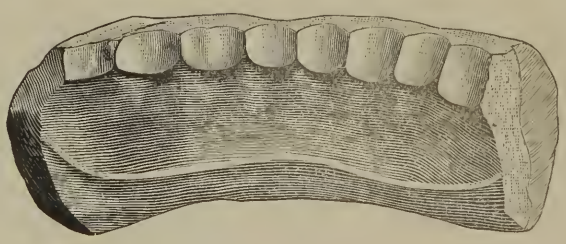
The plaster model, which was used to make the die, is placed in the articulator after the bite has been secured.

A sheet of very thin paraffine and wax is moulded over the tin die and this being *chilled*, it may be removed from the die, and placed on the plaster model, which had been secured to the articulator. The teeth are then mounted on this base plate the same as for rubber work. A thin strip of the same wax is laid as a beading at the upper margin of the plate, as shown by Fig. 182, A.



[Fig. 182.]

The case is then made smooth by blowing the blaze of a spirit flame in little puffs on the wax. It is then removed from the plaster model to the tin die, which is slightly warmed. This should be carefully done, so as to exclude all air from between the paraffine plate and the die. A plaster matrix is now cast over the labial surfaces of the teeth and die as shown by Fig. 183.

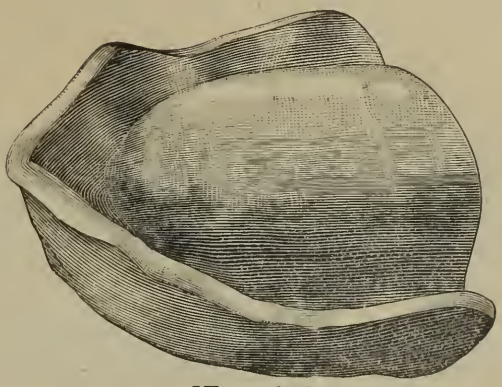


[Fig. 183.]

When this hardens it is removed by dividing it at the median line, and removing it in two halves. Each tooth is now warmed and removed

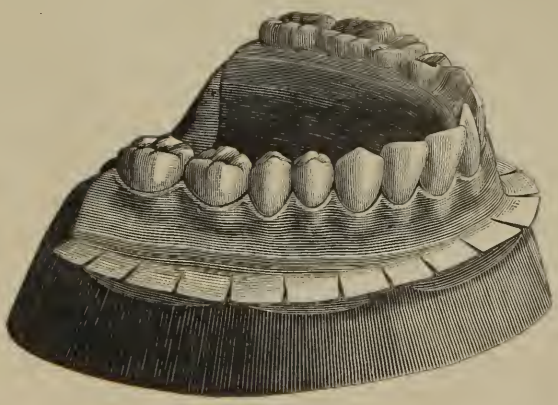
from the plate, and *a drop* of paraffine and wax put into each receptacle left by the pins of the teeth.

This plate is now flasked, (*without the teeth.*) A celluloid blank is pressed up into this mould in a dry oven. *Steam should not be used as it makes the plate porous.* Fig. 184 shows the blank thus formed.



[FIG. 184]

A new, thin base plate, just like the first, exactly the same size, is moulded on the tin die. The plaster matrix is placed in position. Each tooth is put into its receptacle, and the case waxed up a second time. The labial surface of this paraffine is carved as shown by Fig. 182. Thick tin foil (No. 60) is smoothly and neatly burnished over this part of the case and stippled as shown by this cut, (Fig. 182) and brought down to the rim. It is then nicked and bent out at right angles as shown by Fig. 185,

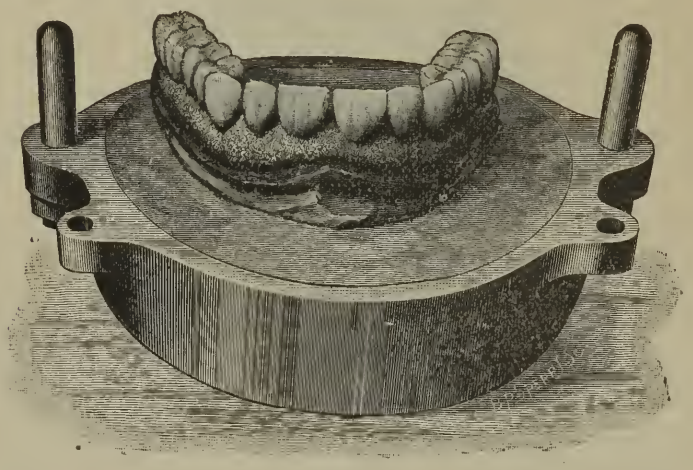


[FIG. 185.]

so as to engage into the plaster of investment. The plaster in the lower part of the flask should be brought up to the wax rim of the plate, but should be clear of these nicked and bent parts of tin foil. Dr. Seabury holds that "*Coarse, slow-setting plaster is an absolute necessity.*" The palatal surface of the plate is also covered with thick tin foil neatly and

smoothly laid on, or imitations of the rugae may be carved on this part of the plate and the foil neatly, *without wrinkles*, burnished on this part of the plate, letting the foil extend up to the inner edges of the teeth, so that there will not be any of the wax plate exposed.

When the plate is thus prepared it is first flasked in the lower part of the flask as already described, and in the position shown by Fig. 186, so



[Fig. 186.]

as to have as large a body of the investment plaster in the front part of the flask as possible. If there should be a deep undercut or protrusion on the front part of the die, this part of the die to be elevated by placing a frame work of matches in the nowel of the flask, so as to bring it at such an angle as will best obtain *dispressure*, when the case is to be pressed up. The investing plaster is then varnished and oiled, and put in a bowl of water, while the plaster investment for the upper ring is mixed.

Nearly fill a pint bowl with water, and *sieve into the water* coarse, slow-setting plaster, taking about a table-spoonfull at a time and sifting it slowly; when you have a little more than is necessary to fill the upper ring of the flask; the bowl should be wrapped, so as to disengage any air that may be in the plaster and the excess of water poured off. It is then stirred with a wet spatula. The batter should be about the consistency of cream, when it is put into the upper ring of the flask with a tea-spoon, beginning at one corner of the flask, so that this investment will strike the investment in the lower part of the flask first. When this is all covered more may be put in until the plaster is nearly on a level with the teeth. The flask is then taken and wrapped against the work bench *for five minutes*, so as to be sure of disengaging all air. After this wrapping of the flask fill the remainder of the upper ring and put on the cover.

Dr. Seabury considers it necessary to have an inclined-guide, remov-

able-pin flask. The pins are removed and by properly heating the flask it may be opened without breaking the projecting investment over the alveolar ridge. All adherent wax about the pins should be washed away with boiling water poured into the flask from a tea-kettle.

The flask is then closed and heated in the celluloid oven until the thermometer registers 320°. "If on applying the wet finger to the tin die there is a hiss, it is too hot. Let it stand for a few minutes. When sufficiently cool place the flask containing the celluloid blank Fig. 184 (which was prepared as before described) on the part containing the die and then into the heater. Apply pressure very gently at first. In from five to ten minutes the flask will close. In any case do not continue the heat in the machine longer than ten minutes."

"When the flask is closed, lock, remove from the oven and place it in water until the plaster is soft. If with a knife or other suitable instrument, you cannot pry the celluloid off the die, put it in a tin basin of cold water over a flame. The tin cast will heat before the water boils, when the plate will be easily removed."

POINTS.

It may be well before concluding this article to give some points in the construction of artificial teeth.

1 —The best and most reliable material for taking impressions of the mouth both for partial and entire cases is *plaster of Paris.*

2 —The impression should be taken with the plaster made into a paste of medium consistence, not too thin.

3.—Plain teeth with pink rubber to imitate the gums are preferable to gum sections, as better articulations can be secured, and more natural and artistic work can be made.

4.—In partial lower cases where the six front teeth remain, with one or two bicuspids on either the right or left side are the most troublesome cases. The bicuspids should be extracted before the case is undertaken or it will result unsatisfactorily to both the patient and operator.

5.—The hard places in the mouth should be raised or lifted on the model by the use of thick tin foil as described in these papers.

6.—The flask in the vulcanizer should not be covered with water but the rubber should be hardened in steam as has been advised.

7.—In making an entire upper, where the natural lower teeth remain, or an entire upper and lower set, *the six front teeth should not touch each other.* The pressure should be on the two bicuspids and first molar on each side, the last molars on both the upper and lower sets should just barely touch.

8.—Looking at the artificial teeth from the front of the mouth, the *bicuspids* should be hidden behind the *cuspids*, and these teeth, as well as the molars, should incline towards the inside of the mouth; both the

upper and lower incline towards the tongue. By inclining the back teeth in this way the upper set is less apt to fall while eating, and the lower teeth are held better in place, as the pressure is exerted in such a way as to keep the upper teeth in place.

9.—It is preferable, in constructing entire sets for both jaws, to mount the lower set first, letting the teeth rest over the ridge and after these are mounted in wax, to mount and antagonize the upper set.

10.—In making a lower plate, be sure not to have it too wide. Pull the cheeks and lips of the patient, and observe while doing this if the plate is displaced; if displaced the plate is too wide. The patient also should be told to raise the tongue to the roof of the mouth. If on doing this the plate is lifted or moved it should be cut narrower on the inside. A mechanical dentist speaking on this subject observed: "In making a lower plate, cut it until you think you have spoiled it, then cut it a little more."

11.—There is such a diversity of opinion about the "central air chamber," whether it should be used or not, that we prefer not to advise on this point. Most patients, however, prefer to have the strong adhesion which a central air chamber gives rather than the adhesion which a plain plate gives when the plate is merely lifted from the roof of the mouth.

12.—In selecting teeth as to shade we have found it best always to err on a darker than a lighter color.

13.—Dr Haskell advises on inserting an upper plate to dip it in water and to place it over the gum giving an up and down motion like a pumping, when, if bubbles of air are seen to issue between the gum and edge of the plate the inference is that the plate fits. He says also to test the fit by using the point of an excavator at different points on the plate, and if this fails to dislodge it from the gum, it is presumed that the plate fits and will not fall in eating if the articulation of the lower teeth is correct.